Reprinted from the JOURNAL OF NERVOUS AND MENTAL DISEASE, 1893.

THE EPILEPTIC INTERVAL;

ITS PHENOMENA AND THEIR IMPORTANCE AS A GUIDE TO TREATMENT.

BY

WILLIAM BROWNING, PH.B., M.D.,

Lecturer on Anatomy and Physiology of Nervous System at the Long Island Hospital; Attending Neurologist to the King's Co. Hospital; Member of the Brooklyn Society for Neurology; of the American Neurological Society; the Association of American Anatomists; Etc., Etc.

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THE EPILEPTIC INTERVAL—ITS PHENOMENA AND THEIR IMPORTANCE AS A GUIDE TO TREATMENT.[1]

By WILLIAM BROWNING, M.D.,

Brooklyn, N. Y.

A RESTATEMENT and amplification of the known interparoxysmal manifestations of the epileptic may in two ways aid us to a rational treatment:

1. To a certain extent by furnishing positive indications for the transient or constant use of various remedies, especially with a view to the more exact application of those recognized as possessing some value.

This is simply in line with present demands, as various writers (Seguin, J. Stewart, Diller), have called attention to the diverse nature of the cases classed under this head, the necessity for individualization, and the importance of training the nervous centres, and of "general measures conducing to the proper performance of function in every organ and tissue of the body."

2. Principally by supplying an index to the progress of the disease, independent of the seizures, and hence a guide to the regulation respecting abatement of treatment where progressive improvement results.

General descriptions of epilepsy, and statistical works bearing thereon, are numerous, and in their way fairly satisfactory. But the symptoms of the seizure, the general type of the accession, pre- and post-spasmodic phenomena, and pathological findings have absorbed the attention of observers and a large space in all descriptions. These are largely intermittent, often not observable by the physician, and withal of little importance to us except diagnostically. Commonly there are some phenomena immediately preceeding or following the

[1] Read in part before the Brooklyn Society for Neurology, Feb. 11, 1891, and in abstract at the meeting of the Medical Society of the State of N. Y., Feb. 7, 1893.

convulsions, that are attendant rather than interparoxysmal. Where the attacks are very frequent these quasi-spasmodic manifestations may, of course, be present during the whole interval. These need only be mentioned here when closely allied to the phenomena to be described,—though it is not always clear how far the latter are but residual effects of the convulsions, and how far independent symptoms.

Then there are various continuous conditions occurring in or affecting these patients, and that go to complete any full description of epilepsy, but that must here for the most part be ignored.

But there is a mass of other phenomena, fairly continuous or frequently recurring in the interim of attacks, not characteristic, and hence diagnostically of only relative value, yet of the greatest importance in guiding treatment. As confirmative evidence of the existence of epilepsy, however, their value is greatly enhanced by the fact that most of these aberrations are *objective*. Some may choose to class them as neurasthenic symptoms; but if so, they are those of epilepsy and none the less valuable. These matters are usually passed as insignificant or too uncertain to be further considered. Little, if any, notice is taken of them in the recent works on this subject; though more in a few special articles. The best consideration of them, so far as it goes, is in an old but most admirable paper by J. R. Reynolds. ("Some Phenomena of the Inter-paroxysmal Condition of Epileptics, and their Relation to Treatment." (*London Lancet*, 1855, ii, 100; 120).

Hence we may clinically distinguish paroxysmal, pre- and post-spasmodic, interval, and continuous conditions in epileptics,—these, of course, to some extent, overlapping and passing into each other. This brief recapitulation and classification of clinical features shows more definitely the limitations of the field included in this paper. It was my original purpose to present only personal observations, but some reference to the work of others will help to make this outline more interesting and systematic. As a basis are taken the notes made in

150 consecutive cases of epilepsy seen in dispensary practice, in years 1884 to 1891 inclusive. Of course, such data are in many cases very incomplete. In estimating the frequency of single symptoms, only a portion of this number can consequently be utilized according as each symptom or its importance was recognized. As regards many of these, some inconstancy of occurrence even in the same person was common. The patients have been, for the most part, of fair mental ability, thus contrasting with the more degenerate and advanced institution inmates on which many of the large records have been based. From the nature of observations made under such conditions, the proportion of anomalies found will err, if either way, in being too small. For convenience these will be considered under the various organs or functions as headings.

(1).—The Pupil.

A. Inequality in size (Anisocoria).[2]

The condition of inequality of the pupils, technically termed anisocoria, is not very rare even in persons of average health. No great importance attaches to it in any class of troubles, but as an *objective* sign it is worthy of further study.

Its occasional occurrence in epilepsy has long been noticed, and a diagnostic value has even been attributed to it in suspected cases of the nocturnal form (Fürstner, 1886).

It is of course merely a symptom, occurring casually where there happens to be some implication, if only exhaustion, of the pupillary paths or centres.

In this series of 150 consecutive cases of epilepsy the condition was noted altogether in 16,[3] although varying

[2] From a paper presented to the American Neurological Association, September, 1891, and here reprinted, with slight change, from The Journal of Nervous and Mental Disease, January, 1892.

[3] In one other case it was questionable, but put down as negative. In still another, the outline of one pupil may not have been quite regular.

22 years, while two-fifths ($\frac{2}{5}$) of the whole series were over that age. One of these three older patients was a typical Jacksonian, another was probably some secondary form of convulsions, and the third showed slight indication of tabes: hence it is evident that in idiopathic epilepsy, anisocoria occurs predominantly among the younger patients.

A few quotations from authorities at hand will serve for comparison.

Schleick (1886), in examining 127 hospital epileptics, found only one case of decided difference in the width of the pupils, the eyes being otherwise normal. Marie (*Arch. de Neurolg.*, 1882, Paris) observed an inequality in 8 of 53 institution cases (about 15%), the difference amounting to $\frac{1}{2}$ mm. in 6 and to $\frac{2}{3}$ mm. in 2. Musso (1884, quoted by Hare) found that there was in 22.8% (of 70 cases) an inequality of the pupils. Addison (1867, also from Hare) found an inequality in 2 of 50 insane epileptics.

Dr. C. A. Oliver, of Philadelphia, from his studies on 50 adult American male epileptics at the Norristown Asylum (*Phila. Med. Times*, Feb. 5, 1887), says: "Pupils are, *as a rule*, equal in size and alike in shape." Recently (1892), however, he has favored me with the exact facts of his cases as follows: "Of the 50 males examined, where, as far as possible, so called idiopathic cases were examined, 7 (exclusive of eight instances which were debarred after most careful testing, upon account of manifest unequal nerve changes and difference of refraction) with unequal pupils were made evident by variously tried experiments—thus giving 15%—an amount that allowed me the broad general expression as quoted."

In a few cases (*v.* JOURNAL NERVOUS AND MENTAL DISEASE, May, 1892, pp. 371–2), inequality of pupils (mydriasis of one eye) has been observed in severe bromidism. some in degree and constancy. Of these 16 cases, 12 were males and 4 females; of the whole series of 150, 84 were males and 66 females. Only 3 ($\frac{3}{16}$) were in patients over

As to the proportion in non-epileptics, or as to what proportion of the above cases may be due to local anomalies of the eye itself, we have no figures for comparison.

The different proportions found by the above authorities may be partly due to closeness as well as time of observation. For, in frequent cases, there is just a suggestion of inequality, yet not so pronounced as to be at first unmistakable. Moreover, the condition seems to be somewhat more frequent and more marked directly after an attack. The different age of the patients, as already indicated, may have some influence.

Probably the above proportion in my own cases, of 16 in 150, might have been increased had the slighter inequalities been more carefully sought, especially in the earlier cases of the series. But a close scrutiny even of this limited number suffices to show certain important differences, and to suggest more exactly why there may readily be a wide diversity in such statistics.

Three somewhat distinct types are distinguishable:

1. Where there is a very considerable inequality.

This form—doubtless the only one heeded by many observers[4]—occurred in a special class of patients. There were three such cases, and each was in an epileptic with decidedly unilateral symptoms. These were all in younger males, though of course this form might well occur at any age.

One of the three was a syphilitic with typical Jacksonian seizures. The second was probably hereditarily syphilitic; when finally relieved of his epilepsy the pupils gradually became equal. The third patient had suffered a traumatic cerebral hemorrhage as a cause.

These cases show that any great inequality of the pupil in an epileptic depends on some localized intracranial trouble; *i. e.*, it is then not so much an epileptic as a focal symptom.

Of course it goes without saying that in plenty of cases of unilateral epilepsy there is no anisocoria.

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[4] As, *e. g.*, Schleick and Addison, mentioned above.

2. Cases of slight inequality, and in which the condition is fairly constant.

This does not preclude some variation from one observation to a subsequent one. In a few cases the immediate effect of the seizures is noticeable, but even then it is rather to accentuate the condition than to develop it anew each time.

Of this form there were ten examples, indicating that it is more frequent in epileptics than the other two forms combined. In certain of these the difference was so trifling that the observation had to be independently corroborated before its acceptance. Doubtless in these cases the peculiarity is only functional. It might simply be classed as an exhaustion-sign, like the pareses seen at times after seizures, but for its greater persistence when once present. Sometimes in these first two forms the wider pupil was observed to react less than the other, indicating (according to Heddæus) that then the inequality was due to sphincter-paresis of the wider pupil.[5]

3. Latent anisocoria—distinct inequality only in faint illumination.

Various non-epileptic cases first convinced me that there is a frequent form of latent pupillary inequality—possibly not well recognized as yet—and that a more exact method of examination and specification might be adopted.

These were cases of astigmatism, brain-tumor, old apoplexy with atrophy of one optic nerve (the most striking case of all), various other nerve troubles, and also individuals otherwise apparently normal. In these there

[5] Dr. James Oliver (Brain, October, 1888, p. 359) says: "When the pupils are unequal [in epileptics], the least effort at accommodation may determine equality, the inequality only reappearing with the state of comparative rest. In testing the reaction to light, I have frequently remarked that, whilst the pupils may, in conjunction, react well to this excitation, separately the one more dilated will be found to contract with less certainty and less markedly than the smaller, and at the same time, manifest a greater tendency to return forthwith to its pre-existing state of dilatation."

was a more or less marked inequality during faint or poor illumination, but such inequality quite disappeared on strongly and generally illuminating both eyes.

Dr. J. C. Shaw also tells me of a case in a syphilitic ataxic in whom, with scant illumination, there was irregular outline as well as inequality of pupils, both abnormal conditions disappearing completely on exposure to strongly diffused light.

To guard against the frequently deceitful effects of shadows, if lateral illumination be used in examining for slight degrees of this form it should be tried alike from each side before deciding.

As a plausible explanation it may be suggested that whilst the passive (*i. e.*, sympathetic) innervation of the pupils is in such cases unequal or disproportionate, the reflex impulse—equal for the two eyes—is, when fully called into play, quantitively so far in excess as to completely overbear all passive ones, and so for the time being to wholly dictate the pupillary condition. The relative superiority of the oculomotor control of the pupil, as compared with the sympathetic, is of course a matter of every-day observation.

This explanation interprets the morbid phenomenon as a symptom resulting not simply from bilaterally uneven sympathetic action, but as one that only appears at times when the action of the oculomotor is relatively or absolutely in abeyance.

Hence we should distinguish:

(1) A passive or latent anisocoria.

(2) An active or at least continuous inequality.

If possible, the type observed should always be specified. Of course the first two forms of inequality above described belong to the second of these classes.

Certainly, even with this precaution, it remains a relative matter so far as estimating the degree of illumination; and in some of these latent cases the visual power was greatly reduced in one or both eyes. The minimum limit is, however, furnished by the least illumination consistent with a proper inspection of the pupil.

Although most of these observations were in other troubles, this form was demonstrable in 2 of the last 50 epileptics; and a recent examination of an earlier case (still an epileptic) discloses a marked example of this. Doubtless an ignoring of this matter in making examinations might give a certain diversity of results, although, as a whole, an exclusively latent inequality is evidently not very common in these patients.

As a rule, including the epileptic cases, the inequality even in least illumination was very slight; but in one case (non-epileptic), it was as great as almost ever seen from natural causes.

Of the three classes of cases, it can confidently be asserted that in the present series all those of the first class have been noted; and hence, for this type, they may serve as a proper average (1 in 50).

But at first, little attention was paid to the second and third classes. If, however, only the last 50 cases in the series be considered, it transpires that amongst these pupillary inequality occurred 8 times (those of the first form all happened to occur in the first 100 cases). This gives 16% and agrees very well with that of Marie (15%) or that of Musso (22.8%). Together, these give 32 cases of anisocoria in 173 cases of epilepsy, or about 18.5%. With this the results of C. A. Oliver above quoted also harmonize. In other words, it appears that on an average one epileptic in every five or six will, if examined with care, prove to have some, though usually slight, inequality of the pupils. As this conclusion is based on the fairly harmonious results of observers in different countries, it is admissible to infer that those finding a smaller proportion must have simply overlooked the common slighter difference in size of the pupils.

In the 56 insane epileptics examined with Dr. Knapp (*v. infra*) there were 5 cases of unequal pupils.

B. Oscillation of the Pupil (Hippus pupillæ).

This proves to be one of the most constant interparoxysmal manifestations in epileptics. Excluding the insane, it is with few exceptions to be found in all cases

when carefully sought, though, of course, varying greatly in degree. Some note regarding this was made in 41 cases. These were not all consecutive, as some were too restless for a satisfactory examination of this point, and others were referred or briefly seen once and then lost sight of. But the proportion of positive and negative results must be fairly correct [2] for this class of patients.

In two of these cases, both girls, no definite oscillation was detected (but two absolute negatives in forty-one cases). In five others it was absent or doubtful at some time, but reappeared; resp. was first detected at a subsequent examination. In perhaps eleven others (9 m., 2 f.) it was usually slight in extent though unquestionably present. Of the thirty-nine positive cases twenty-three were males and sixteen females. This corresponds to the proportion of males and females in the whole series, and certainly shows that it is not a special result of feminine characteristics (oversensitiveness, hysteria), though possibly more marked in that sex.

It should be remembered that normally, on reducing illumination, the pupils dilate evenly and steadily, and on arriving at the proper maximum width simply rest there. This does not exclude a decreasing rapidity as they approach the resting point; nor a considerable variation as to the promptness with which they respond, the speed with which the response ensues when once begun, nor the extent of their response.

But in the cases here referred to, there are excesses and irregularities of pupillary movement not to be explained by any of these normal variations.[3] Several distinct but frequently co-existing types of this anomaly can be distinguished.

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[2] In private practice, perhaps owing to the quieter circumstances under which the patients are seen, the proportion of positive cases has seemed to be less, though not radically so.

[3] In the every-day use of the ophthalmoscope, as my friend Dr. Alleman informs me, it is not uncommon to observe a slight fluctuation in the pupil on first throwing the light into the eye. Whether this be due to involuntary changes in accommodation or to other influences is not clear.

1. In this form the act of dilating only is peculiar. This takes place in a series of jerks; a very slight contraction often, but not always, occurring at the pauses. As a result, the whole period to the maximum dilation is considerably prolonged. When present, this peculiarity is usually bilateral; *i.e.*, it may then be observed in either eye on covering the other. However, it may not be equally marked in the two eyes. It is occasionally observable in older children, in adults and in those suffering from other troubles, or, at least, not known to be epileptic. This form was noted in eight cases, although the minor distinctions were not always recorded. Even more minute descriptions might be given, as *e. g.*, a slow wavering dilatation that ends with a big jump.

Charpentier has called attention ("Behavior of the Pupils in Epileptics," quoted in *Therapeutic Gazette*, May, 1890,) to a condition that he describes as "a rapid, transient, and variable difference in the size of the two pupils, somewhat resembling the temporary inequality produced by closing one eye for a short time and then suddenly opening it. The phenomenon is produced sometimes at very short intervals in the same subject; it is unconnected with any fit or vertigo, or other symptom of epilepsy, and it has no prodromal significance; but it would appear to be liable to be evoked in any epileptic when he is under the influence of emotion, especially if he has difficulty in expressing himself." C. has not seen it occur apart from emotional disturbance and effort, and so far has only noticed it to be a dilation of the pupil, progressively increasing or alternately dilating and contracting. He thinks that if these observations are confirmed by others, the sign may be of value as revealing the existence of the epileptic neurosis. From his erroneous view that the pupils become unequal on covering one eye for a time, it is probable that what C. really observed was hippus of the type just described.

2. The reverse of this—*i.e.*, a serrated contraction—has not been observed with certainty in any of these cases,

and is withal of rare occurrence. Recently H. C. Wood (*Univ. Med. Magaz.*, April, 1889, p. 385,) published such an observation in a non-epileptic case, but where there was lateral homonymous hemianopsia from a tumor in one temporal lobe, with softening, etc.

A simulation of this reversed serration may occasionally be noticed in epileptics, viz.: when the reflex-contraction is limited (*e. g.* in very poor illumination) and immediately passes into that form of tremor soon to be described (*v. infra*, form 4).

3. This form is also a part of the dilating act. It seems to be intermediary between the first and fourth forms, although less frequent than either. Here the primary dilation occurs smoothly, but instead of stopping at the right point it goes too far. Then it contracts back also too far. This leads to a short period of diminishing contractions and dilations until the pupil settles down steadily at the proper width. The first dilation usually achieves the greatest maximum, each succeeding one being less.

4. This form, although classed under hippus, might be distingushed as tremor pupillæ. Here the oscillatory movement of the pupil does not occur as an apparent feature of the reflex act, but is more or less continuous. If pronounced, it can be observed when both eyes are exposed (illuminated). It is the most common form (34 times). The extent of this spontaneous motion is very variable, and in the two eyes not always equal, *i. e.*, on covering one eye the tremor of the opposite pupil is greater than is observed on reversing the procedure. But in many cases its average is fairly constant for considerable periods—weeks and even months—though the seizures be fully controlled.

The motion may be called rhythmic, though it does not seem to follow any sequence, a slight movement being followed by a larger or an equal one, or conversely, without any apparent rule or equal interval of rest.

Evidently, a variety of this is where, on exposing one pupil, a steady, even slow, dilation occurs and seems to

stop quietly at its maximum; on continuing the observation for some seconds, however, a variable, slow, but often increasing oscillation, becomes apparent.

In examining for these pupillary movements, there are certain necessary or favoring conditions:

(*a*) Vision should be directed to a distant object, *i. e.*, convergence, and accommodation excluded and the irides correspondingly relaxed—an attitude of staring. With many patients this is easily accomplished; but there are numerous epileptics at least, including older and willing patients, who seem quite unable to keep their gaze steadily fixed.

(*b*) The phenomenon is decidedly more pronounced on exposing only the observed eye, the other being covered. Frequently it can only be detected in this manner, and in all cases the type can thus be more satisfactorially studied.

(*c*) The oscillation is greater in poor than in strong light. Consequently a dull day, twilight, or some distance from the window or source of light is most favorable. In total darkness these movements might be still greater, but, for purposes of observation, some illumination is imperative. Of course, whatever be the illumination, it should not vary during any single observation.

(*d*) Mental or psychic stimulation has been found to greatly increase the extent of the oscillations. Some have attributed similar mobility wholly to mental effects.

(*e*) Before excluding every form of hippus the observation should be continued for a full minute or two, should be made on each eye singly, and should even be repeated after a week's interval.

On the contrary, very dark eyes, browns and blacks, render such observations far more difficult, and as they require better illumination, a negative result is more probable.

Some few previous observers have remarked the occurrence of hippus in epileptics. Charpentier has been already mentioned.

Schmeichler (*Wiener Med. Wochenschr.*, 1885, No. 41) says

that he has seen what he terms "spontaneous pupillary movements," "besides in healthy, generally sensitive individuals, mostly in females, the number of which is not great; in drinkers,[4] *e. g.* directly after an attack of delirium tremens, and in epileptics on the slightest psychical stimulation." In one of S's cases (suspected epilepsy in a soldier) it served to warrant the diagnosis until more certain proof was obtained. He adds, that so far as he knows the only previous observer of anything of the kind was Schadow, "who says he had seen variations in the size of the pupil during continuous equal illumination; these he referred to the influence of psychic and sensory stimuli."

Schmeichler concluded that these pupillary movements were synchronous with the respiratory as observed on the cerebral vessels. My various attempts at confirming this explanation, so far as it applies to epileptics, has been but partially successful. In a majority of such patients—S's explanatory observations were made on other cases—there is no visible connection between the respiration and these movements. In a few, however, some relation between the two can be made out, although even then the dependence is but partial, the respiration merely affecting or increasing the hippus without entirely controlling it. Occasionally the winking act also affects it either as a coördinate action, or more probably through a quickly responding light-reflex. The interesting observations of Dr. C. A. Oliver in a case of migraine are also against the theory of a respiratory cause, (noted in Sinkler's article, *Med. News*, July 19, 1890, Repr.): "Spasmodic action of the right iris, causing the pupil to dilate and contract irregularly; this spasmodic action being felt by the patient as a twitching or a series of movements." A couple of years later, at an attack, the following was noted: "The right-sided hippus was again complained of, and upon careful study was found just as pronounced as at the previous examination. The

[4] This cause is noticeable since alcohol, in the case of some individuals, suffices to bring on convulsions.

iris excursions, which were quite extensive, were found to be fifteen times in each half minute upon monocular exposure, and but six times in the same length of time upon binocular exposure."

Damsch has observed "hippus,[5] aside from affections of the eye itself, in changes in the chiasm with subsequent hemianopsia, in paralysis of the oculomotor nerve, in nystagmus, in epilepsy, in the early stage of acute meningetis, but relatively, most frequently in multiple sclerosis. * * In chorea there was no hippus. Neurasthenic patients showed it occasionally."

It is true that hippus is very common in disseminated sclerosis; in fact sclerosis, chronic alcoholism, and epilepsy are its main causes.

Are these pupillary movements simply the result of the convulsions, or are they coördinate phenomena, indicative perhaps of an unstable condition of the sympathetic? The latter view is undoubtedly the correct one in the main. For, in several cases, it has been possible to follow them months after the cessation or subjection of all paroxysmal manifestations. In such instances the hippus may continue for a long time unchanged, eventually to subside by degrees if a real cure is achieved. This is further indicated by the fact that, in the first form, the oscillations occur only during passive dilation, and in the fourth are stronger, the more the influence of the oculomotor is excluded (*v.* also Damsch's observation, above cited, of hippus in oculomotor paralysis), *i. e.* they occur in either form so soon as the dominating influence over the pupil is left to the sympathetic. This view must be correct unless we assume that the oculomotor innervation becomes rythmic when weakened.

This might suggest the old theory that the convulsive disorder rests on vasomotor spasm, or, better, that in epilepsy the sympathetic control is unstable, weakened or wavering. And C. A. Vanderbeck (*Phila. Med. and Surg. Reptr.*, 1877, i., p. 411) mentions oscillatory movements

[5] "On Pupillary Unrest (Hippus) in Diseases of the Nervous System." *Neurolg. Centbl.*, 1890, (*v. Knapp's Arch.*, April, 1891).

of the iris as a premonition of an epileptic attack, whilst other observers have noticed rapid pupillary changes as occurring in the post-paroxysmal stage (exhaustion or reaction).

The ages of the epileptics showing hippus have ranged from 6¼ to 51 years. There were six observed therefore, over twenty-one years of age, and of these six but one failed to show some hippus. The oldest was a man of fifty-one years (attacks for four years but only every few weeks; a moderate drinker). The number of these older patients showing hippus is too limited to warrant such positive conclusions as to its frequency in them as do the younger cases.

In fifty-six epileptic insane (15 f., 41 m.) whom I was enabled to observe at St. Johnland last summer through the courtesy of Dr. H. J. Knapp, then of the Asylum staff, this phenomenon was not marked in any case and was absent in a majority:—negative, or so slight as to be doubtful, 33; slight, but distinctly obtainable, 17, including five in which it was unilateral; too restless for observation, 6. This small proportion was not due to age, as of the ten minors included only two were positive. The trouble in controlling accommodation, etc., in such patients render their statistics on this point of less value except as showing the general fact that the epileptic insane exhibit this manifestation to but a slight extent. Hence, as its degree or occurrence in them also bore no relation to the frequency of their attacks, it is evident that the hippus is not an effect resulting from the seizures but is a separate or coördinate matter.

It is of course necessary, in order to correctly estimate the value of this symptom, that we should know the frequency with which it occurs in non-epileptics of like age.

Schmeichler (*l. c.*, No. 41, 1248) says: "These spontaneous pupillary movements—so far as they occur in normal individuals—are less often observable in males than in females; the puberty-years present the largest contingent; in old people I have never seen them." However, in fact they do occur in morbid conditions now and then in persons up to middle life and thereafter.

As to their frequency in non-epileptic children, the large number of choreics under observation at the same time as the epileptics furnish a good criterion, inasmuch as they are also suffering from a nervous affection. Occasionally a choreic child also exhibits this hippus, despite the statement of Damsch, but the proportion is small. In fully healthy children I have never discovered any indication of it.

As to the differential diagnostic value of this sign, it follows from what has been said, that it can only be relative like most other symptoms. But as it is objective, it may at times prove very valuable. A better knowledge of its frequency in other troubles will here prove useful.

Before closing with the pupil, it might be specified that these phenomena of themselves do not call directly for any treatment. Possibly they may suggest the propriety of remedies specially acting on the sympathetic system.

NOTE.—It was claimed by L. C. Gray (*Am. Jrnl. Med. Sc.*, Oct., 1880, also *Am. Jrnl. Neurlg. and Psychiatry*, vol. i., 1882), that a dilated and mobile pupil was diagnostically significant of epilepsy. He says: "By a dilated and mobile pupil, I mean one that is always more or less dilated, even in bright light, and which undergoes the changes from contraction to dilation; and conversely, in response to light or accommodative movements, much more quickly than does a normal pupil."

This was quickly combatted by P. Maric (*l. c.*) from Charcot's clinic. Musso (*v.* Hare) made similar tests on seventy epileptics and ten healthy persons, with conclusions, as regards Gray's statements, corresponding to those of Marie.

There is, however, a probable element of truth in Gray's claim to an unusual proportion of wide pupils amongst epileptics as he observed them, his critics examining a different class of patients and under other circumstances. The assumed over-mobility of pupil described by the above quotation would, however, be something quite different from hippus, and is only mentioned here to avoid possible confusion.

As to the condition of the pupil in the attacks, Seguin (*Bost. Med. and Surg. Jrnl.*, 1891, i.) gives dilation and immobility as constant in *grand mal*, frequent in *petit mal*, and uncommon in psychic epilepsy.

ZONULAR THICKENING AND PIGMENTARY CHANGE OF IRIDES.

There is another peculiarity, of the iris rather than the pupil however, that is frequently noticeable in epileptics. It is also common in a variety of other subjects, as old drinkers, one case of slight rheumatic neuritis, persons giving evidence of premature senility—in a word, the physically degenerate. Perhaps it is on a par with the well-known *arcus senile*, though coexistence of the two was noted in only one case. .

The peculiarity *in appearance* consists of a thickening of the iris, progressively increasing on its exposed surface from its periphery to the outer border of the narrow circularly contracting inner ring (*i. e.*, to the zone of the constrictor pupillæ), which latter preserves fairly its natural thin appearance. During the contraction and dilatation of the iris this outer band is seen to remain immobile like a shoulder-ring, inside and perhaps beneath which the active part plays. At the same time this major part of the iris in seen to have lost its bright "finished" and mottled surface, and to be of a dull, sodden, even color. This condition has alway been bilateral—apparently equal on the two sides. In younger epileptics there is often an iridial condition present that may represent an early stage of this peculiarity. The outer surface then has a hazy indistinctness almost impossible for the observer satisfactorily to focus, without, however, having, to any great extent, lost the general tint of its original color, nor as yet developed a marked shoulder. Irregularity and variety of pigmentation in the same iris is then not rare.

My records do not warrant any exact statement as to the frequency of these conditions in epileptics, except

that they are common (especially noted in ten cases, the youngest 13 years of age).

As to any tendency to a narrowing of the pupil or slighter reaction to mydriatics—both of which might be suspected if there is an analogy with senile conditions—I have no observations to communicate. And the same holds as to whether the condition, even in its partial form, is recoverable. My ophthalmological friends have not been able to offer any information with regard to the matter, unless the suggestion of an œdema-like infiltration of the relatively inactive portion of the iris. Possibly in the epileptic cases the continuous pupillary oscillations above described are a factor in its causation.

(2).—Other Ocular Peculiarities.

A. of the motor apparatus.

1. The various anomalies in refraction and the relative muscular insufficiencies are matters that have been so recently discussed that they may be quickly dismissed. Briefly, the theory seems to be that the effort required to overcome temporarily these impediments to perfect vision tires the nerve-apparatus and so excites or frees the convulsive centres. However, in many cases, these ocular weaknesses or defects may more justly be regarded as results, or as interphenomena of the epilepsy and of the attending weakness of the nervous system than as its source. Ocular errors in epileptics certainly should be corrected as carefully as possible, just as all other aberrations from the normal.

2. Distinct paresis paralysis or contracture of external eye-muscles is much more frequent in epileptics than in average persons. This may develop suddenly at some convulsion. Mauthner has suggested that such an occurrence often depends on the development or existence of a tubercle (somewhere in the central path), and this probability may be worth remembering in the treatment. Where the epilepsy proves amenable this condition may improve and even disappear.

Altogether, there has been such easily recognizable weakness of one or more external eye-muscles in ten of the last sixty-seven cases. Of these ten, there were six with distinct paresis or strabismus, and four of latent diplopia; of these four, however, one showed unilateral ptosis, another slight latent anisocoria, and a third slight (paretic) nystagmus on extreme conjugation as also relative weakness of one abducens. By deducting from the sixty-seven the twenty-four who were over 21, we find that all the ten cases were in the forty-three consecutive patients under age—certainly a surprising proportion and perhaps too large for general application.

Schleick (*l. c.*) notes the frequent occurrence of squint in the absence of any motor paralysis of the eye. Hare (p. 22) mentions diplopia or hemiopia as sometimes existing for twenty-four to forty-eight hours before an attack. The fact that in one patient strabotomy had been performed before onset of the epilepsy, that one patient has a healthy boy with congenital unilateral ptosis, and another, a sister, with a turning-in of one eye from fright, suggests that we should be guarded in attributing grosser disturbances in the eye-muscles to the effect of the seizures.

3. Various epileptic patients have shown a peculiar restlessness of the eyes, an inability to steadily concentrate or long continue visual attention, whether for far or near objects. This is quite different from nystagmus which, aside from paretic eye-muscles, does not seem to be common.

B. OF THE RETINA.

1. Ophthalmoscopic changes.

The condition of the retinal circulation in epileptics has been the subject of much observation and mild contention. Vance (*N. Y. Med. Jrnl.*, 1871, i., 144,) endeavored to obtain a therapeutic indication from the state of the retinal vessels. In anæmic conditions he used strychnine, alternating this with bromides when any hyperæmia was noticed. Clifford, Albutt, Cross, and others, have noted

changes believed to be more or less characteristic. But Gowers, and many expert ophthalmologists have since thrown discredit on the availability of such observations. Knies' investigations (1888) had reference only to the period of attack. Oliver (*l. c.*) has, however, since reached the following positive conclusions: "(10) Optic disk superficially over-capillary, with a decided grayness in its deeper layers, showing a low grade of incipient optic-nerve degeneration. (12) Fibre-layer of retina increased in thickness, as evidenced by dense and course massings of striation extending in all directions from the disk, these being more particularly marked in the superior and inferior portions of the eye-ground, even hiding the edges of the disk itself in many instances. (14) The retinal veins exceedingly tortuous, and in a few instances pulsating. (15) Retinal arteries frequently wavy and sometimes tortuous, especially the temporal and macular twigs. (16) Retinal lymph-channels visible in the majority of cases, particularly seen along the larger vascular distributions and at the vessel-entrance as glistening and yellowish opacities."

Schleick found no gross ophthalmoscopic retinal changes, although in 52 of his 127 cases (41%) slight deviation from the normal.

Gottardi (*v.* JOURNAL NERVOUS AND MENTAL DISEASE, Oct., 1881, p. 843): "Permanent alterations of the fundus of the eye are most frequent in cases presenting a symmetry of the face and skull, already recognized by Voisin, Müller, Dumas, and Hasse. During the attack, and better still, after the attack, temporary alterations occur in the vascularization of the fundus of the eye, or, isolatedly, of the central vessels of the retina. These alterations are, however, of no value as a means of diagnosis in cases of simulated epilepsy, as they occur under the influences of other causes."

It is scarcely necessary to quote further on this point. Until the ophthalmologists can offer more definitely accepted positive results, we are warranted in ignoring the retinal appearances so far as the epilepsy is concerned.

2. Limitations of Visual Perception (field, color, etc.).

C. A. Oliver found (in Asylum cases, however,) the visual fields for form and color reduced from $\frac{1}{3}$ to $\frac{1}{20}$ of normal areas, the diminution being regular without indentations or scotoma, and the color-perception being subnormal to a slight degree.

This hamonizes with the investigations of Wilbrand, Ottolenghi, Thomsen, and in part, Lombroso, who found even concentric contraction of the visual field with sometimes a diminution of visual activity, such changes, however, being largely due to the paroxysms.

(3).—The Heart and its Action.

Though numerous recorded cases have shown that abnormal cardiac manifestations occur in epileptics, often with irregular action of the vasomotors, the matter does not appear to have received its share of attention. The subject is here followed out almost exclusively on the pulse, or by auscultation. With a little experience and care everything of importance can thus be detected, and this with greater certainty and satisfaction than by any of the common sphygmographs. Tracings in several cases, made with a Dudgeon instrument, showed graphically such variations as could be most readily followed in that manner. But equally important matters can not easily be thus recorded.

It soon transpires that a sound and normally acting heart is the exception rather than the rule in epileptics. Of the following deviations therefrom—these are simply such divisions as I have found clinically convenient—more than one is often observable in the same patient, and some individual variation from time to time is not uncommon.

Rarely there is organic disease of the heart, in the shape of valvular defects, dilatation, hypertrophy, fatty degeneration, etc. Far more frequently functional disturbance is all that can be made out. From the nature of dispensary work it has not been possible to examine

many by percussion, and the few so examined failed to show much of interest.

No mention of the pulse or heart is made in thirty-six cases. Some of these did in fact also present cardiac symptoms but that failed to get recorded. This impairs the exactness of the statistics, though not their general bearing. In sixteen of the remaining 114 cases it is specially stated that nothing abnormal or worth mentioning was found. As nine of the sixteen were seen but once, it is possible that they were not studied with the requisite thoroughness. There were, however, definitely negative results sufficient to show that, so far as the methods of examination practiced could determine, there is a certain proportion of cases—not over one-third at the most—that fail to show any cardio-vascular symptoms. It is on the other ninety-eight cases that the following positive observations were made, these representing per contra at least two-thirds of the whole series.

The so-called epilepsia vasomotoria is a special form of attack, and therefore is here excluded.

A. VALVULAR LESIONS.[1]

Rarely these are factors in causing epileptic seizures, though, even when present, their significance has been questioned. Whether or no such a lesion is ever produced by the paroxysms, certainly when once started it may thus be increased in degree. The fact that it is often the mitral does not help much in deciding.

There were four of these cases (in the 150) besides four others in which the sounds were blurred or obscure. Although many cases were not auscultated, still this was done in all presenting suggestive symptoms, and it is believed that few, if any, marked cases of this kind were overlooked. The four positives all showed mitral murmurs (regurgitant). Two were in females (aged 7 and 50 yrs.), and two were in males (aged 48, and 63 yrs.).

[1] These, with the furred tongue, the adenoplasias, etc., described below, of course really fall under the head of continuous conditions mentioned in the introduction.

Hence this condition is evidently more common in adult than in young epileptics. In at least two of the three adults, the seizures developed each time on signs of the heart failing, but were quite banished so soon and so long as the heart worked well. In such cases there can be little question of the etiological relation of the cardiac injury. Here the seizures have some of the elements of a syncope but their suddenness, an occasional biting of the tongue, and some convulsive movements attest their kinship to epilepsy. Doubtless, the weakening effect on the circulation is the factor for evil. In one case, as the heart-trouble became less and less compensated the seizure diminished to forms of *petit mal*, though recurring much more frequently.

The literature on this point is considerable, as a few references will show.

Flint once described ("Disease of the Heart and Epilepsy," *Am. Med. Ti.*, Jan. 12 and 19, 1861) the case of a man of thirty-two, in whom epilepsy was believed to have developed after damage to one or more valves, although considered merely a coincidence. The Index Catalague mentions an early case of Horn—"Merkwürdiger Fall einer Epilepsie von einer organischen Krankheit des Herzens entstanden," *Arch. für med. Erfahr.*, 1808. J. W. Martin has published such a case ("Epileptic Seizures; Presystolic Mitral and Systolic Aortic Murmurs; Anæmia; Health Improved Under Treatment." *Med. Press and Circ.*, 1875, i., 383).

In four of the five cases given by Hollis ("Epilepsy with Cardiac Complications," *Practitioner*, 1879) there were signs of valvular trouble and cardiac enlargement. Lemoine (*Rev. de Medc.*, 1887, quoted by Hare) "reports five cases of cardiac epilepsy, in which valvular disease of the heart existed, and where great amelioration of the symptoms or recovery occurred upon the use, either singly or together, of such cardiac stimulants as digitalis and caffeine."

Valvular murmurs were made out by Dr. Knapp in eleven of the fifty-six insane. These were all aortic but

two, and none were very marked—representing presumably slight and purely secondary changes.

CARDIAC EPILEPSY.

Evidently some confusion exists in the use of this term. Various writers have endeavored to distinguish a so-called *cardiac* epilepsy due to organic (valvular) disease of the organ. This form is sufficiently illustrated by the cases just cited, except that any disabling organic affection of the heart may doubtless be as deleterious as exclusively valvular affections. As to the real existence of this form and as to its importance there can be no question. The confusion has arisen from the designation chosen therefor; since, under a like title, an altogether different form—and one not further belonging here—has been described and seems to be more often intended (Stokes, the partial epilepsy of Trousseau—more strictly a local epilepsy like the various tics; the "Cardiac Epilepsy and Essential Tachycardia of Talamon," 1891; Paroxysmal essential cardio-motor nerve-storm of H. C. Wood, 1891).

B. RAPID PULSE—TACHYCARDIA.

The paroxysmal form of this just referred to, is, of course, not here intended. But otherwise, this is very common. It was noted in fifty-three of the cases, besides a dozen or more others in which it was but slightly, or at times increased in speed. By this is meant a pulse that is commonly or continuously fast, and not merely so from some passing cause. In children especially allowance must be made, not only for the normally increased rate, but also for excitement from the examination, though this latter disappears on gaining the little patient's confidence.

Hence we may conclude that an overrapid pulse is more or less constantly present in from one-third to one-half of all cases of epilepsy.

As to what should be termed a fast pulse when the person is sitting quietly, it is here assumed as eighty or

over for adults and ninety or over for (older) children. Twice (in children) it has run as high as 120, while 116, 108, 104, 100 are fairly common. After making the above allowance of ten more beats for children, there does not seem to be any special influence attributable to age or sex, although some to the frequency of seizures.

This symptom can usually be controlled by digitalis. But it requires a very careful adjustment of the dose, as an over-effect is but too readily produced, or a fast but regular pulse gives place to an intermittent or irregular one. It seems impossible in some cases to get the desired even regulating effect of the drug. The more the rapidity is due to local conditions of the heart, the better the effect of digitalis; the more it is due to central and nervous conditions, the less amenable does it seem to this drug (as to influence of enlarged lymph-glands, *vide infra* sub 9). The average in forty-one male epileptic insane, as determined for me by Dr. Knapp, was 91½, and for fifteen female 92¼.

THE PULSE-RATE AT DIFFERENT AGES.

As a standard for estimating aberrations in speed, the results recently worked out by Langlois (*vide Bost. Med. and Surg. Jour.*, 1891, II., p. 68) for the normal pulse may serve: "Between the ages of fourteen and forty-five the normal rate is very nearly 70 beats per minute. Below the age of fourteen the normal rate may be found by the formula $P = 140 - 5A$, the pulse-rate being represented by P and the age by A. After the age of forty-five it is found by the formula $P = \frac{1}{2}(95 + A)$."

However, in applying any such standard to ambulatory patients some little margin should be allowed before classing a speed as either abnormally fast or slow.

C. WEAK HEART.

A small or weak pulse was noted in twenty-nine cases (11 m., 18 f.) exclusive of the few showing valvular troubles. To a large extent these were the same cases

as those with a rapid pulse (eighteen of the twenty-nine cases), though the reverse is not as striking.

Of course this is largely a matter of judgment, and can only be estimated after duly considering the patient's age, sex, physique and activity. The fact that an over-proportion were females suggests that due allowance may not have been made for sex.

Again, often there is so much variation after either short or long intervals as to exclude the case from this category.

In twenty-four of the fifty-six insane, a weak heart was specially noted by Dr. Knapp—and this does not include those with valvular lesions.

D. SLOW PULSE—BRADYCARDIA.

An abnormally slow pulse, 48 to 60 beats per minute, was noted in only six cases—the youngest aged sixteen, the others over thirty. Though the pulse-rate in none of these was below 40, it is now recognized that bradycardia, even in the latter restricted sense, is occasionally an epileptic accompaniment. The more pronounced of these cases, as also the more typical of those quoted below, were all in males.

Recent investigations show further that it may be difficult to distinguish between slow and certain forms of intermittent pulse (*v. infra.*). Many of the cases are reported by English writers, usually under the qualifying designation of Epileptiform.

F. St. George Mivart (*Lancet*, Jan. 3, 1885) describes this in a man of sixty-one years—P. 20 sitting, 24 standing.

A. F. Gibbings (*ibid*, No. 7) reports a case in a man of sixty years, with a previous intermittent pulse of about 60, but which on the development of epilepsy dropped to 12 and then until death continued at from 24 to 30 beats.

Drummond (*Brit. Med. Assoc.*, reported in *N. Y. Med. Recd.*, 1890, ii. 333) tells of a man with a pulse of 13, in-

creasing to 36 and 40 during an attack of influenza, and then falling to 5, 10 or 15 per minute before the advent of the epilepsy.

Corkey and Hubberty have also (*Brit. Med. Jrnl.*, May 10, 1890) contributed a case in a man of sixty, whose pulse ranged from 11 to 76. The convulsions occurred during the intermissions of the beat. Autopsy showed mitral incompetency.

In Sigg's case (given by Seguin in Sajous' Annual, 1889) the pulse-rate finally sank until it was only "24 to 21 per minute, with intervals at times of from 5 to 15 seconds. In many of the attacks the pulse was only 9 per minute, with indistinct tremulous heart-sounds and a faint systolic murmur."

These cases are somewhat different from those of the present series. The slow pulse seems in part to have been a paroxysmal occurrence; again some more or less marked organic change in the heart was evident. No particular significance seems as yet to have been attached to this symptom, except that when very pronounced it favors the advent of the seizures. Dehio (1892) has found that atropine relieves bradycardia when due to nervous and not intra-cardiac troubles.

E. IRREGULAR HEART—ARYTHMIA, INTERMITTENT PULSE.

Under this head are often included the three types next following, but in practice it is nearly always possible to distinguish them.

In arythmia, as here intended, there are more or less sudden breaks or changes in speed. The jump may be either slight or great, and either to faster or slower rate. Commonly these sudden alterations show no definite regularity in their recurrence or extent. In the closely allied Intermittent Pulse the beats may be dropped, only now and then, in some of which cases it is accordingly necessary to observe a long series of beats and even on different days before it is detected. In other cases there are sudden pauses and complete breaks in the pulsation.

Naturally the first form of this shades off at times to the next type—that of Variable Rhythm. Exclusive of the valvular cases an Irregular Heart was distinctly observed in only ten (6 m., 4 f.). In at least some of these it had no direct dependence on the convulsions. Distinct irregularity or variability was noted in ten of the fifty-six insane epileptics.

Hollis (*l. c.*) says: "In the majority of these cases this [cardiac] derangement showed itself in that rapid and irregular pulse which has been * * * * * described as diagnostic of muscular feebleness of the cardiac organ." The following from a German review of Bard's article (*Gaz. hebd.*, 1890, No. 18) is especially relevant to this form: "Permanent rhythm couplè, of which the so-called pulsus bigeminus is the lightest form, occurs in severe affections of the nervous system. In these are found the highest degrees of the arythmia in question, and which can very easily be mistaken for an abnormally slow pulse. According to Tripier this form of pulse is found particularly in epileptic affections, especially in larvated forms of the same."

F. VARIABLE SPEED OR RHYTHM.

This is very frequent. It was noted in forty-five of the one hundred and fifty cases (27 m., 18 f. or as 3 : 2). As forty-one of these were in the last one hundred cases it may be concluded that like the rapid pulse this is present in over one-third of all cases. However, tachycardia and variable rhythm were both observed in the same patient only 21 times, showing that there is only a limited interdependence between the two.

The change in rapidity of beat may take place almost suddenly and then, though slight, be very noticeable—approaching definite arythmia. Or the variations may be quite gradual, *i. e.*, the change may be of either quick or slow completion. Again, the variation in speed may follow a regular sequence, or be entirely irregular in its occurrence. In still other cases it is only noticeable on

comparing different days, one day regular at say 84, the next time 108, then 90, etc.

To examine for this point fairly, all influences that ordinarily suffice to affect the rhythm should be excluded; the patient must first have settled into as quiet a condition as possible, both physically and mentally.

G. VARIABLE FORCE.

This is closely allied to the previous form, yet the two are far from parallel. The rhythm may continue perfectly uniform and yet the force vary (two cases).

This also may occur slowly, like a long wave, up and down, or it may intersperse level intervals, or again be characterized by some suddenness without becoming distinctly irregular. Like the Weak Pulse, its estimation is largely a matter of judgment.

This pecularity was noticed in ten cases (6 m., 4 f.), but this limited number probably includes only those in which it was prominently marked in comparison with the previous forms.

H. IRRITABLE, SUSCEPTIBLE, OR CHILDISH HEART.

This is where its action is too much or over-easily affected, as by mental effort or rising and sitting. It is closely allied to Variable Rhythm, and in several cases (8) both were present. This peculiarity is rather common, both with and without other definable aberration in the heart's action. Still it was specially noted in only twelve cases (7 m., 5 f.). One of these patients was but eight years old, the others all over fourteen.

Though Irritable Heart has been recognized since the time of Graves, it is not often mentioned and has perhaps no mathematically exact significance. As an example, if on directing a youth's attention to some unexciting matter or on simply engaging him in conversation, his pulse-rate suddenly increases 20 beats, he has been credited with an Irritable Heart.

I. SENSATIONS (PALPITATION, PAIN, ETC.) IN THE HEART REGION.

Such subjective phenomena throw little light on the primary condition; nor is it always possible to say with certainty what is the real seat. An aura from this part is not rare, and in some other cases the sensations are associated with the attack. Otherwise, palpitation is most frequent in adult females (16 cases in all; 6 m., 10 f.) and is withal more common than all other sensations together. In two of these (1 m., 1 f.) it was, however, only associated with the attacks, 1 (m.) only suffered at night, and 1 other (m.) had a mitral lesion. Of these sixteen, there were thirteen over twenty-one years of age, indicating that it is principally an adult symptom.

There was also eleven cases (7 m., 4 f.) that complained of unpleasant feelings in this region. Direct complaint of pain is now and then heard (in one case associated with dyspnœa, in one in the mornings, in another from walking), though it is more often a "lump" in the cardiac region, "in the left side," in the region of the stomach, etc.—perhaps gastralgic.

It is principally in angina pectoris that there is any understanding of the relation of local sensations to the cardiac condition. However, Nothnagel has recently described the frequent painful sensations—anginal and continuous, also cutaneous hyperalgesia of precordial region—in valvular affections especially aortic. He adds that quite analogous painful sensations occur in affections of the myocardium without valve-trouble (myocarditis, fatty heart, hypertrophy, both idiopathic and especially from arterio-sclerosis). Chew (1892) divides cardiac pain into three forms—true angina, pain from Bright's disease, pain from dilatation of heart.

Fear and timidity as a characteristic is so common to children that little account can be made of it. That its physical basis is so often associated with cardiac irritability or undefined sensations from the cardiac region, and that fright and sorrow are among the recognized causes of epilepsy, are the reasons for mentioning it here.

REMARKS ON THE CARDIO-VASCULAR SYMPTOMS.

Observations of some length and at different times are requisite before all these abnormal features can be excluded. Mental and physical excitement in the patient must also be guarded against.

It is proper to consider whether other persons similarly circumstanced do or do not present like phenomena. Without giving exact figures, it may be said that a continuous series of choreic and other children have been brought to the clinic during the same period as the epileptics. But, although attention has been directed to it, no similar proportion of aberrations has been found. In the choreics, irritable heart, cardiac murmurs, and regional pain are frequent, but the other deviations exceptional.

The further question arises, how constant is any one or any combination of these in the same individual? The influence of the attacks on the cardiac phenomena is more marked than on the pupillary. Otherwise they persist for weeks and months with but slight variation, diminishing gradually if the person be progressing towards a cure.

PRE- AND POST-PAROXYSMAL CARDIO-VASCULAR PHENOMENA.

The variations in cardiac action, above described, are not always the same about the time of the seizures. Where these latter are frequent the short intervals may present only spasm-phenomena. But where the intervals are longer we can usually distinguish the symptoms attending the paroxysms from those intervening and more continuous. They are not altogether alike even in kind.

Towards the approach of a seizure there may be a decided accentuation and increase, occasionally even sufficient to warrant the prediction of an impending attack. The opportunity of observing shortly after a

seizure is more frequent. In a possible majority of cases we then find the aberrant action more marked, and it may be only at such times that any of these peculiarities appear. But not rarely the opposite is then found—a full regular pulse where at other times weak and fast; and this latter may occur even where the seizure has been *preceded* by an increased disturbance.

Voisin, Magnan and Féré have described and studied the pulse-changes about the time of the seizure. The last observer, from experiments on healthy subjects, showed that after violent muscular efforts the same modifications were present; but he also (1889) found an increase of 200 to 300 grammes in the arterial pressure *during the aura.*

François-Franck (1887) by cortical irritation produced changes in the blood-pressure and the heart-action, both with and without epileptic seizures.

PATHOLOGY.

Are these cardiac phenomena—representing, as they collectively do, a weakening and irregularity of the heart's action—exclusively the result, more or less grossly mechanical, of the repeated heart-strains which the convulsions certainly produce?[2] That those of the interim may be to some extent, and those directly after the paroxysm are largely of this origin is clear. Or is there also a direct nervous influence affecting abnormally the heart or vascular system? And secondary to the latter question is another—whether such morbid nerve-influences are active only about the time of the paroxysms, or are they to some extent continuous?

[2] This is doubtless the cause of the total hypertrophy of the heart with dilatation observed in epileptics by Jastrowitz of Berlin (reported in *Wien. Med. Wchr.*, 1889, No. 31, 1212–1213). The dilatation is on a par with that which sometimes occurs acutely in severe chills, only that by repetition it is increased and becomes chronic. To meet the repeated strains the heart, if able, hypertrophies just as *e. g.* from the hill-climbing of Oertel. J. however calls it idiopathic disease of the heart-muscle, and assumes an unknown nervous influence.

The fact that as a premonition of the seizures there may be decided alterations in the pulse, that during the aura-stage there may be a great increase in the arterial pressure, that where the free intervals are of much length it may be quite possible to distinguish between the paroxysmal and the inter-paroxysmal pulse-changes, and finally that in cases of definite heart-lesion it has repeatedly been possible to fully control the convulsions by regulating and strengthening the heart's action, and yet only so long as this latter was possible, all these facts disprove the hypothesis of a purely mechanical or secondary origin of these pulse-changes. They indicate that there is some other factor, evidently some form of nerve-influence and not limited in time of action to the paroxysms alone. That this is of cortical origin is rendered probable by the experiments of Franck already mentioned.

THERAPEUTIC INDICATIONS.

These cardio-vascular manifestations give a strong warrant for the use of digitalis in selected but numerous cases. This drug has been mentioned favorably by various writers, but has hardly been accorded its full right. The fact that it acts not alone on the heart but on the arteries in general makes it especially useful. In a certain minority of cases it is far more important and lasting in its benefit than the bromides, though readily combinable with them. But both to secure its best effect and to allow of its prolonged use, *small doses are demanded.* A drachm to a drachm and a half of the tincture a week is all that can advantageously be given for any length of time. Two drachms a week is the maximum for even short periods. Later it may be tapered to half a drachm before stopping. Of course this applies to youths and young adults.

Occasionally strophanthus may better fill some indication, but its different action makes it less generally available. My trials of it in epilepsy have not been

encouraging, however satisfactory in troubles of other kinds. But possibly the later commendations (*e. g.* by Poulet) should be accorded some consideration.

Nux or its alkaloids are known to be occasionally invaluable for a short preliminary treatment in conditions of weak heart.

In most cases the use of tobacco in any form, especially by youths, is to be condemned. Various toxics (as tobacco, coffee, tea, alcohol) are amongst the best recognized causes of tachycardia and other functional heart troubles, and hence are to be considered injurious for most epileptics.

In some cases, not only of valvular trouble, but where there is a weak heart without special lesion, the plan of lying down if warned by a sufficient aura or other premonition—will abort an attack. This plan has proven more often possible in private than in the duller dispensary patients. It is also attested by a well-known case of Stokes. Some intelligence on the patient's part is necessary and an imperative realization of the urgency and importance of this little procedure. In the same sense, lifting or overwork (too rapid, prolonged or excessive) is in cases with such weak circulation to be carefully guarded against.

Occasionally, on the contrary, it is true that labor improves the patient, and without doubt, as urged by Putzel, some occupation suitable to the patient's physical ability is advantageous rather than otherwise. It is only to be remembered that many of these subjects are not able to do a fair average and are greatly injured by any excess.

(4).—Respiration.

(*a*) Cases. Special respiratory phenomena during the interval are not common. In 4 cases the patients had suffered much from bronchitis, but 2 of these also presented mitral murmurs. In 6 others dyspnœa had been troublesome, especially on walking fast, climbing stairs, or other vigorous exercise. These were to some extent persons that tired easily on any muscular effort. In 3 further cases frequent sighing was noted. In

others the unfavorable influence of bad air is mentioned.

(*b*) Respiratory capacity. Féré (1888) finds that in the intervals the expiration is prolonged in most epileptics, and that the whole respiratory curve is spasmodic and jerky. He points out that epileptics, more often than is generally supposed, seem to present permanent convulsive phenomena. He also (1889) finds the respiratory capacity of the chest in epileptics to be decidedly less than normal. "The diminution of the respiratory capacity is augmented with the number of fits, and seems to be dependent upon paresis of the muscular mechanism of the thorax." Féré's work indicates that the bromides do not deserve all the blame for the occurrence of phthisis in epileptics that has been attributed to them; and a recent paper of Agostini's (*v. Neurlg. Centralb.*, 1891, p. 568), directly combats the reality of any such influence of the bromides.

(*c*) Seasons, climate, atmospheric pressure, etc. In a small percentage of cases only is the influence of the seasons noticeable—*e. g.*, decreased severity during the winter months—although in reality this factor has quite as much bearing on the circulation as on the respiration. The paper of Eskridge of Colorado (JOURNAL OF NERVOUS AND MENTAL DISEASE, 1887), indicates that altitude and moisture probably have little influence. Ingram has pointed out (N. Y. Neurological Society, Feb. 4, 1890), that sudden barometric and thermometric changes, particularly the former, are potent in producing epileptic explosions.

(5).—APPETITE, ASSIMILATION, BLOOD, URINE, ETC.

A. The peculiarities and capriciousness of the epileptic's appetite are well known, though it is too often assumed that they are all over-eaters.

1. Not rarely there comes an epileptic who, for considerable periods at least, has but a poor or indifferent appetite (20 in 150; special notes regarding these matters were, however, made in only 85 cases). That anoxexia may be a temporary sequence of the attacks disappearing quickly of itself, and that bromides may produce a like

effect, are every day observations. But in the present cases it is usually either a symptomatic manifestation disappearing as the disease improves, or often is due to putrefactive processes about the oral cavity, upper air passages or stomach, and then requires some direct at tention in treatment. When any further appetizer is required the bitter stomachics usually suffice.

Not to be confounded with these are the unfortunates who have been subjected to severities in diet. We oftener see this from the mistaken zeal of friends in restricting the allowance of food than from poverty. Such starvation-cures do not help, but injure epileptics. What with their convulsions, insufficient food, unsatisfied cravings of hunger, and perhaps the exclusive use of bromides, their condition soon becomes pitiable. It is quite time to discredit such unnecessary and harmful severity. Even as regards the seizures, such a case immediately improves on receiving proper nourishment. Pepper even advocates (*N. Y. Med. Record.*, 1881, II.), a hygienic course resembling Weir-Mitchellism, to include rest in bed, feeding, bathing, etc., as very advantageous in numerous selected cases.

2. Many of these patients, on the contrary, have a large, even a voracious appetite. However, exclusive of bulimics, a good appetite was specially noted in only twenty-two cases. For the most part they crave meat, sometimes a particular kind of meat, as pork, or even more exclusively, ham; the hobby, however, may be for bread, cabbage, sweets, tea, or other articles. This appetite is not capricious, but fairly continuous,—unless at certain meals, or about the period of attacks, or during intercurrent troubles. Hence it seems to be a natural longing, to offset the exhausting effects of the disorder, and should not be too much restricted—beyond regularity of meals, the avoidance of any single excessive meal, the exclusion of recooked meats, cabbage, or fried articles, and possibly the limitation of meat to two or even to one meal a day. Various reported experiments with nitrogenous and non-nitrogenous diets have shown how little influence these matters exert.

3. Quite separate from the general condition of the appetite, or from the freakiness of this type of individual, are the true bulimic attacks to which certain epileptics are subject (specially noted in but six of this series). This bulimia usually, if not always, bears some relation to the seizures, preceding them a short time—from a few hours to a couple of days. Hence it belongs rather to the premonitory phenomena, though possibly at times substitutive. It must not be wrongly inferred that these overfeedings bring on the attack, for this will occur no matter how sharply the food-supply may be controlled. Such transient but insatiable ravenousness, however, is clearly a nervous manifestation and no warranted craving of nature. Hence it is imperative at such times to limit and closely watch the dietary. Some cases of alcoholic epilepsy are probably of this nature, the craving for spirit like that for food being but a preliminary to an attack.

B.—THE MOUTH.

1. Coated tongue. This is important not only symptomatically, but also as constituting an evil in itself. It is very common. The tongue is usually more furred far back, gradually lessening until the tip and sides are free. It is very resistent to treatment, though sometimes improved by care as to diet and constipation.

2. Drooling was troublesome in three weak-minded patients. Gingivitis, a bad taste in the mouth, a bluish (metallic) line on the gums, were noticed a few times. Dental troubles, as a direct cause, have been described by a few writers, notably by Brubacker of Philadelphia.

3. Enlarged tonsils. This condition is, perhaps, closely allied to the hyperplasia of cervical glands considered below, and to nasal and ear troubles. When at all obstructive direct treatment is demanded.

4. Foul breath. This, quite independent of that form so often noticed after use of the bromides, is overcommon amongst epileptics (5 cases in a series of 25; and of these 5 there were 4 under seventeen years of age). When possible these patients should be taught to

take scrupulous care of the teeth and mouth, as the oral conditions just mentioned often play a part. Or there may be a rhinitis or nasal obstruction that needs attention.

These indications suggested by the condition of the breath are important, as the usually present decomposing material, wherever it be, must continually poison and weaken the system as well as affect the digestion injuriously.[1]

C.—CONSTIPATION, ETC.

1. Intestinal torpor is recognized as one of the frequent banes of epileptics. It was noted in eighteen cases as being continuously or often troublesome; whilst in twelve the bowels were regular, or even over free (exclusive of paroxysmal diarrhœa). This condition is in many of these patients subject somewhat to their vagaries in eating. Consequently eructations, pyrosis, abdominal pain and bloating, colics, diarrhœa, etc., may be simply from indigestion. The dyspeptic symptoms and constipation have been attributed to the direct action of the drugs on the gastric mucous membrane. This assumption is but partly true, as epileptics *not* under medication often enough have these troubles, whilst per contra they frequently subside as the epileptic tendency abates, even where bromides are employed.

2. The character of the bowel-discharges of epileptics has scarcely received sufficient attention. My first observations on this point were quite casual, but a little further attention thereto has thrown some light on various of their digestive disturbances. The passage of coarse unmasticated and undigested fragments occurs to

[1] The idea of Thomson (JOURNAL OF NERVOUS AND MENTAL DISEASE, 1890, p. 246), that ptomaines from the intestinal tract may, by their toxic effects, sometimes be a factor in epilepsy, serves to emphasize this, and Griffiths has (1892) extracted a poisonous leucomaine from the urine of epileptics. Herter, of New York (American Neurological Association, June 22, 1892), from comparative estimation of ethereal sulphates in the urine, finds that in numerous cases there is evidently increased putrefaction just before the seizures. Pommay (1881), Massolongo (1889), and others have described a form of "gastric epilepsy," considered by the former to be a reflex and by the latter an autotoxic effect.

a surprising extent. The stools at times seem largely composed of such material. This indicates that in the first place they do not properly masticate their food, and on this point a few words of explanation may be in place. The foods that should be thoroughly chewed, include vegetables, cereals, fruits, nuts, etc. (hydrocarbons). For their proper digestion it is desirable that they be reduced to a state of fine division, and then, also, well mixed with saliva. But as regards meats, fish, etc., this is not as imperative. It has been found experimentally that the muscle-fibers are more easily digested if not in a state of overfine division ; the stomach then retains them longer and can better roll and reduce them. All recooked meats and hashes are objectionable as compared to fresh cooked or cold meats.

Again, as to the manner of chewing. There is a prevalent idea that slow eating is very favorable to digestion. But this is largely fallacious. The important point is not that we eat slow or fast, but that when we do eat we chew with energy. Of course, where the haste is due to some mental anxiety this may injuriously inhibit the secretions. Slow eating begets a habit of simply mumbling the food without really masticating it, whilst the hurried eater is inclined to swallow before proper mastication. Hence, hurried eating is bad, but rapid mastication is advantageous. It concentrates our energies on the act in question, and hence more thoroughly accomplishes it. Moreover, energetic chewing stimulates the secretion of saliva in the most favorable manner.

These various points are so commonly misunderstood at least by the laity, that they demand our frequent attention. Especially is this matter important in the case of epileptics, whose guardians and attendants should be carefully instructed to supervise not so much the food of their wards as the manner in which it is consumed. As to the success of such watchfulness, the physician has a fair control by taking frequent occasion to inspect the passages for evidence of the nature suggested.

D.—SYSTEMIC CONDITIONS.

1. The body weight. A record of this gives a valuable clinical control over various matters, irrespective of the claim of Kowalewsky (1881), that there is a fall of 1 to 12 pounds in weight after every kind of an epileptic attack. Various observations counter to K.'s claim are summarized by Hare. But other than this an estimation as to the natural or morbid character of the appetite, the too excessive loss from use of the bromides, etc., is thus possible. In children it also gives a measure of their growth,—and not rarely these attacks begin or change at the period of most rapid development.

2. The blood—chemical changes. The few that have been noted, unless anæmia, are of paroxysmal origin. The anæmia also may, as shown by Féré, be thus caused, but where persistent should raise a suspicion of toxæmia or other basis. Schmitz (reptd. in *Neurlg. Centbl.*, 1892), has found that a venous hum can often be heard over the jugular in epileptics.

3. Dyscrasias. These fall largely under the head of continuous conditions. In any large series of cases there will be one or more due to congenital or acquired syphilis, malaria (*v.* the writer's article in *Brooklyn Med. Jour.*, January, 1893, p. 23–4), rickets, gout, rheumatism, lead, alcoholism, etc.

4. The urine. Any special frequency of albuminuria in epilepsy, even as a post-paroxysmal occurrence, has been disproven (*vide e. g.*, the summary in *Univ. Med. Magz.*, December, 1888). It thus becomes a valuable symptom in distinguishing uræmic convulsions from epilepsy.

According to Dr. Johnston Smith (*Jrnl. Ment. Sci.*, October, 1890), the phosphoric acid is slightly increased. Charcot's conclusions regarding the different ratio of earthy to alkaline phosphates in epilepsy and hystero-epilepsy, refer to paroxysmal conditions.

(6).—SEXUAL LIFE.

The influence of epilepsy on the sexual functions and period is known to be considerable, although this applies

chiefly to the female. Fertility rather than sterility is unfortunately common. Some of these women are relatively exempt from attacks during pregnancy and to this is probably due the mistaken notion, popular in some countries, that pregnancy is curative of epilepsy.

At least 13 of 36 females between the ages of fourteen and forty-five years, showed some disorder of the sexual apparatus. Amenorrhœa (8 cases) and irregular menstruation are common,—exclusive of certain cases attributable to medication (bromides). Occasionally in girls, and even in women, a fœtid vaginal discharge is troublesome. There was one case of small ovarian cyst, one of prolapsus uteri, and one of ovariitis, besides others of pain in ovarian region.

Physicians often comfort mothers of young girls with the hope that the convulsions may cease upon the advent of menstruation. Except in the rarest instances such hopes are bound to suffer disappointment. Puberty is far more liable to bring an increase than any decrease in the severity of the morbid condition. The exceptions are only the occasional respites that occur at any time. It it well known that in women the attacks, even of idiopathic epilepsy, often recur with greater frequency about the menstrual epoch.

(7).—Skin and Extremities.

(*a*) Cold hands or feet—subjective or objective, usually both—are common, more, of course, during the cooler months. In a few the immediate unfavorable influence of the seizures is the chief cause, but many suffer much at all times. Of the latter there were twenty-one cases (1 only at night, another variably cold, then hot; in 6 only the hands were specified; in a few general chilliness also). This condition is usually assumed to indicate a sluggish circulation. But sweating of the soles and palms is generally the intermediary cause of the coldness, as this leads to abstraction of heat both by conduction and evaporation. Bromhydrosis also may be troublesome, perhaps more during the warm weather.

Whilst these perspiratory troubles may demand local measures, it is their constitutional treatment that has more than symptomatic significance. The dermatologists teach that the most powerful excitomotors, notably strychnine, are amongst the most serviceable internal remedies.

(*b*) General hyperidrosis. Excluding the palmar and plantar surfaces, perspiration to any noteworthy extent, is perhaps not more common in epileptics during the intervals than in other persons.[2] It was specifically stated in fourteen cases (1 in sleep, 1 in armpits principally, 1 formerly).

This is distinct from the very rare cases in which profuse sweating occurs as the precursor of an attack, or is paroxysmal (case of Emminghaus), or finally where it attends or follows an ordinary attack (3 cases of present series). A peculiar case of hemidrosis most marked at attacks, has been published by Brady (*Virg. Med. Monthly*, June, 1891).

(*c*) The frequent relationship of dermal affections to nervous troubles has long been noticed, though still but little understood. Polotebnoff has recently (1891) mentioned epileptic convulsions amongst various severe neuroses observed in psoriasis cases.

The casual observations in the present series include—pruritus universalis with lichen planus, pigment-nævus of face, Duyputren's contracture of palmar fascia, strumous eruptions on face and hands acne cachecticorum (2); intercurrent pruritus (2), gouty eczema, old psoriasis, acne (3) in young men, (not from bromide), leucoderma about eyes and temples (case mitral regurgitant); slow felon on thumb, blepharitis ciliaris, labial herpes (2), and chronic dactylitis.

Féré, in one of his papers on respiratory phenomena, mentions a case of unilateral lentigo (freckles) in an epileptic. Romberg, in his once favorite treatise, says:

[2] Bricon (1882), has even employed pilocarpin in epilepsy. And Boccolari and Borsari (*v. Centrlb. f. Med. Wissc*, 1892), found the galvanic resistance increased after the seizures.

"It appears that the susceptibility for epidemic and contagious diseases is diminished in epileptic patients." Urticaria, as an after-symptom however, has been observed by Zacher and by Pick.

Johnston Smith (*l. c.*) remarks on the rapidity with which the wounds of epileptics heal, their oily skin and their peculiar odor (musty according to some). On the other hand, Dayton (*N. Y. Med. Jrnl.*, 1891, I.), says: "The skin exhibits vascular change, want of complete nutritive support, the color being sallow, patchy or dark, and suggestive of a sluggish circulation."

The conjunctival and cutaneous ecchymoses occasionally seen are post-convulsive residua. According to Sandras (quoted by Harc), when an epileptic is exposed to the sun the skin of the face, and even elsewhere on the body, becomes covered with numerous *taches rosée* without any elevation, and which disappear rapidly when they go into the shade.

(8).—Sleep.

Exclusive of twelve in which the seizures were largely or exclusively nocturnal, some note regarding sleep was made in 96 of the 150 cases. There were twenty-four who were good, quiet sleepers and fairly free from dreams. Hence, typical normal sleep is the good fortune in fully one-fourth of all cases of epilepsy. As a majority of the series were young patients and children, and normally better sleepers than adults, the small proportion here is the more striking. Most of the peculiarities to be mentioned are such as often enough occur in persons of average health, though statistical criteria in this respect are lacking. And yet they become in many cases of value as control-symptoms.

A.—Wakefulness of various types.

This is not very common, although some loss of sleep —from "being a poor sleeper," or not getting to sleep easily, or remaining awake if aroused, all the way to

troublesome insomnia—is mentioned in eighteen cases. Loss of sleep, on the other hand, may make the epilepsy worse.

Under the head of "Insomnia in Children," Simons (*vide N. Y. Med. Jrnl.*, 1890), has given a description that tallies more nearly with night-terrors or even nocturnal epilepsy. "The insomnia of epilepsy is peculiar to itself, and is sometimes the only symptom for a considerable period. The child goes to bed well, wakes with a cry from profound slumber, sits up suddenly in bed, but soon falls back again either to sleep after a short interval or to lie awake, weak and prostrated. These attacks are always accompanied by incontinence of urine."

B.—OVERSLEEPINESS—SOMNOLENCE.

When present this is usually of the morning type, and in patients that are weak or exhausted, or at least have been dreaming, and so have not rested properly. The possible effect of drugs taken (bromides) must be remembered.

Quite different from this are the sleepy states that represent an epileptic equivalent (cases of Westphal, Fischer, Putzel, and at least one in present series; also G. W. Jacoby "Periodical Sleep Seizures of an Epileptic Nature." *N. Y. Med. Jrnl.* May 20, 1893).

C.—RESTLESSNESS IN SLEEP.

This is closely associated with dreams and insomnia. Further, it is apt to occur in those presenting choreic symptoms. Specially noted in fourteen cases. Snoring was troublesome in three, of which two were children of fourteen years. The "Sleep-Movements of Epilepsy" considered by Putnam, of Buffalo (*Jrnl. Ment. and Nerv. Dis.*, 1892, p. 599), were more or less limited and perhaps of some localizing value.

D.—DREAMS.

To these epileptics seem somewhat more disposed than do other individuals. In part they may represent equivalents, although there was no further evidence to

show it. No particular kind of dream predominates, though often disagreeable. Probably their occurrence is not always remembered, and such other evidence as talking in sleep and night-walking might then be accepted. However, there was a distinct recollection of great or frequent dreaming in thirty-five, besides some further cases in which it less often occurred.

This is distinct from the observation of Hammond, that, "An aura may be entirely manifested by dreams and delusions."

Not very rarely these patients are subject to day dreams, evidently a kind of *petit mal.*

E.—SOMNAMBULISM, NIGHT TERRORS, ETC.

In seven cases—only two of which are included in the dreamers or talkers—there was a history of night-terrors or somnambulism. The oldest was twenty-five years, the others fifteen or under (2 m., 5 f.).

Again, in eight cases (5 of these not included in the dreamers), talking or moaning or laughing out in sleep was common.

As a symptom simply it is interesting to note that these morbid manifestations are also common in other members of epileptics' families.

(Compare, also, C. H. Hughes, "The Relationship of Somnambulism to Epileptoid and Epilepsy." *Phila. Ti. and Regstr.*, 1890, xxi, 8).

Night-sweats, cold feet at night, a habit of sleeping on the back or with the mouth open, are worth noting when as not rarely one or more is present.

Where the child persists in sleeping on the back, some rough or angular object can easily be tied against the spine at night.

F.—ENEURESIS NOCTURNA.

Of eneuresis we should remember that it may be a symptom of a seizure. Where, however, this occurs more or less habitually, and especially if observation of

the sleeping child has failed to detect any evidence of corresponding seizures, it may be considered as habitual or symptomatic rather than paroxysmal. It was specially noted in but six cases, although this certainly does not represent all. Some few epileptics have been subject to this in youth, but, as alleged, before the development of seizures.

For comparison, Comby, of Paris, may be quoted (*v. Neurolg. Centbl.*, 1891, p. 445), who observed five cases of nocturnal eneuresis amongst ninety choreics.

Sometimes this habit is associated with mouth-breathing (due to nasal obstruction,[3] nasopharyngeal growths, or enlarged tonsils), in which case the relief of such other trouble exerts a favorable influence.

Various colleagues of my acquaintance, following the advice of Sir H. Thomson, have employed syrup of iodide of iron advantageously for this habit in general cases.

G.—POSITION OF THE HEAD IN SLEEP.

Some epileptics are inclined to sleep with the head overhigh, others with the head very low, or analogous thereto they lie on the belly or with the head covered. This is somewhat of a relative matter. An ordinary pillow and bolster may be called medium; a single thin pillow *or* a bolster may be considered low; whilst a thick pillow *and* bolster or the latter and more than one pillow is certainly high.

Of forty-six consecutive cases, eight are noted as high, twelve as low (including two with head under covers, and one sleeping on belly), five as medium, and twenty-one undesignated, probably also for the most part medium. This indicates that a majority, certainly half, present nothing unusual in this respect.

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[3] Mackenzie in this country, Yoal of France, and others have claimed that nasal trouble (congestion, epistaxis) is frequently due to genital irritation. Conversely, Major in Canada, Ziem, and Kœrner, in Germany, find that eneuresis may be due to mouth-breathing (nasal obstruction); and personal observation in a couple of cases has seemed to corroborate this.

The preferred position of the head during sleep is all the more important, if during treatment—as has repeatedly happened—the patient's habit in this regard undergoes a change. As with the other peculiarities in sleep, the value of this is largely relative, depending on the patient's general condition, the action of the heart, etc. But taken in connection with other occurrences, it may give a valuable hint as to the condition of the brain-circulation (or brain-nutrition if the expression be preferred). Where this latter is poor (anæmia), where severe bromidism is impending or too strong depressants are being used, and in most cases of nocturnal seizures occurring late at night, the person will sleep with the head low. Such patients are often oversleepy, exhausted and hard to arouse mornings, and commonly have a poor appetite for breakfast. To the clinical importance of this group of symptoms in other troubles, I have elsewhere called attention ("The Morning Headache of Continuous Tire and Exhaustion," *Brooklyn Med. Jrnl.*, January, 1891).

These patients can often wear a night-cap advantageously, as also sleep on soft (warm) pillows.

H.—THE EMPLOYMENT OF STRYCHNINE IN EPILEPSY.

The habit of sleeping with the head low makes another interparoxysmal indication for the use of strychnine[4] in epilepsy. The correlated ones are: Seguin's ingenious plan where there is weakness of the ocular muscles; Vance's method based on the condition of the retinal circulation; the above pointed out condition of hyperidrosis and bromhydrosis; Brugnoli's suggestion (1889) in irritative conditions of the vagus—possibly equal to the now well-recognized value of this drug in conditions of cardiac and circulatory weakness corresponding to those so frequent in epileptics; as an agent to relieve severe bromidism.

[4] Or its equivalent; strychnine brucia or their salts, the preparations of nux vomica or of ignatia amara, the compound syrup of the hypophosphites.

Hammond says: "In the nocturnal form of epilepsy strychnine is sometimes remarkably efficacious." And digitalis has also been specially recommended in this form.

All the indications for strychnine in epilepsy are, however, only for its temporary and carefully controlled use. At times it may be kept up for longer periods, but is never a continuous routine drug like the bromides.

Where, on the contrary, the patient sleeps with head high, an overactive brain-circulation is probable,—unless explained by some heart lesion. Consequently, remedies casually depressing are then in place, such drugs as strychnine being strongly contraindicated.

(9).—Enlargement and Induration of the deep Cervical Lymphatic Glands (especially Post-Cervical Adenoplasia).

This condition is very common in children and young persons generally. Tuberculosis, syphilis, rachitis, and the acute exanthemata are the most notable general causes. Throat, scalp, and intracranial troubles act more exclusively local. Though children with almost any ailment easily develop adenoid hyperplasia, a perfectly healthy child free from all residua of disease ought not to have glandular enlargements. They are an indicator of past or present ailment, however slight.

Where these local glands were found to be small, they often seemed harder, suggesting a past process that had subsided, leaving an intractable induration.

These gland-changes appear to be more frequent in epileptics than in others, though we know of no proper data for comparison. The statistics of Van Arsdale (Discussion, N. Y. Academy, January 15, 1891), as he has personally informed me, refer to adenitis and are not applicable here.

Notes regarding these glands were made in 53 of 95 consecutive cases; the other 42 would, it is believed,

average about the same. In 7 of these 53 there was no or but slight and doubtful enlargement. In the remaining 46 there was some, though frequently limited, increase in size,—"limited" referring to the proportion affected as well as to the degree of increase. This certainly represents over one-half of all cases. Of the 53 cases, 15 were over twenty-one years of age; and of the 7 negative cases, 6 were included in these 15 adults. This shows that it is predominently the younger patients that present this feature, and that it is all but universally present in those under age. In but a few of these cases has the condition of the lymphatic glands, in general, been examined. The submaxillaries and the axillaries are often but by no means so generally likewise affected. So far the actual facts.

1. Are these gland-enlargements in epileptics but part of a general enlargement of the lymphatic gland-system, and hence merely symptomatic of some constitutional disturbance? So far as observed it is the cervical glands that are more often and more markedly enlarged. Moreover, in but few cases is there other ground to suspect a systemic taint. Undoubtedly, however, this explanation holds for a certain small proportion.

2. Are they the result of altered brain-lymph, either from some trouble that is also causing the convulsions, or as a direct effect of the congestion attending them? This might be contended, in as much as in a few cases these enlargements have developed or increased whilst under observation.

3. Conversely, can such gland-alterations, whatever their origin, play any part in the causation of the epilepsy? Two ways suggest themselves in which such action might occur.

(*a*) By pressure of these bodies on neighboring nerves especially the sympathetic (trunk, ganglia, outgoing filaments) and the vagus, or on adjacent vessels. Hare says: "A form of peripheral lesion producing epilepsy, probably not by reflex action, is that recorded by Schultz (1855), where prolonged compression of the jugu-

lar vein caused the disease, or in those cases where enlarged cervical glands bring about a similar result." This evidently refers to large pacquets of glands, and even then it is exceedingly doubtful whether compression of a jugular could be an important factor.

The observations of Pröbsting (1882), and of Merklen (1887) have shown that habitual tachycardia may result from pressure on and implication of the vagus by affections of the tracheal and bronchial lymph-glands. Hence in some cases the rapid pulse of epileptics may be attributable to the pressure of enlarged bronchial, and even cervical glands on the vagus. This possibility is, however, hardly a warrant for the surgical removal of such cervical glands.

(*b*) By intraglandular interference with the lymph-discharge from the brain. This effect might be produced by the swelling of the glands or by the subsequent contraction where they subside. Various attempts have been made to establish a connection between brain troubles and the lymph discharge, though with limited success as yet. Little is known regarding impediments to the passage of lymph through glands, although the subject has recently been exploited by Chaffey. Moreever, there are collateral paths from the brain, and any tendency to cerebral œdema in epileptics is not recognized.

THE USE OF IODIDE OF IRON.

The indications for this are:

1. Eneuresis nocturna—already mentioned.

2. Congenital syphilis. In the few cases where there has been occasion to suspect the existence of this etiological factor, more good has followed the use of this than of the iodide of potassium.

3. The glandular enlargements, just described.

4. Anæmic or other conditions demanding iron. In these latter the iodide should be considered before deciding on any other ferruginous preparation.

As to the methods of dispensing, the individual pre-

ferences of the prescriber may vary. If the syrup of the iodide be given separately or not, the usual precautions must be taken. Dilute well and give after meals to avoid irritation of the stomach, and, of course, it should always be taken through a tube.

A fundamental rule in prescribing for epileptics is to limit the number and variety of doses; else, from the necessarily long continuance of medication, carelessness will creep in and ruin any chance of success.

The syrup of the iodide is fairly compatible with glycerine or simple syrup, and also with the bromide of potassium or sodium, but not with the alkaline iodides.[5] With the tincture of digitalis it certainly is not, and a rather dirty looking mixture is the result; yet so far as therapeutic effects are concerned, the result is still satisfactory, perhaps because only a portion of the iodide is broken up or the small quantity of free iodine may be all the more efficacious. Of course such a mixture must be properly shaken before each dose is measured out. The steady action of the digitalis is then not perceptibly interfered with. A combination of bromide of sodium, syrup of iodide of iron, and tinct. digitalis can thus be continuously administered for months without other change than a readjustment of dose or the occasional substitution for a few days of some stomachic in place of the iodide. Some patients, of course, do not bear the syrup well, no matter in what manner given. The dosage has never amounted to over three or four drachms a week, and often less, besides a gradual reduction of the drug when the progress of the case admits it.

As a substitute, a pill combination of iodoform and reduced iron has repeatedly done good service, but there is some question as to the safety of its long continued use.

(10).—Nose and Ears.

The frequent close connection between nasal and aural affections is especially important in these cases.

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[5] For various experiments with regard to this matter, I am indebted to Dr. Chas. A. Byrne.

(*a*) Nasal troubles (obstruction, mouth-breathing, so-called "snuffles," fœtor, naso-pharyngeal catarrh), apparently having some causative relation to the epilepsy, are not very rare, though scarcely more common than in average children. They are nearly all related to hypertrophied tonsils, and perhaps even to the enlarged lymphatic glands already considered. The relation of eneuresis has been mentioned, and the condition termed aprosexia might be added. A case of "nasal epilepsy," with some historical notes, was recently published by Roe (Transactions N. Y. State Medical Society, 1890).

(*b*) Ear troubles. Many of these are connected with the naso-pharyngeal affections. Boucheron (1885) described an auricular epilepsy occurring in childhood and youth, and other observers have recorded cases originating from ear disorders (either directly from irritation of the adjacent dura, or as a reflex). The favorable local conditions here for retention and pressure, as well as the consequent exquisite painfulness of inflammatory and exudative processes may explain the readiness with which convulsions are produced.

Although little attention was paid to aural symptoms, some note of them was made in twenty cases. Tinnitus (ringing, hammering, buzzing in the ears) occurred in twelve. In three it was only on one side; in one an aura; in few, if any, was it continuous; in a few it came at particular times, as on going to sleep or on waking. Tinnitus aurium, apart from distinct dizziness or adequate ear trouble, is then not rare in one or both ears—probably oftener where the cardio-vascular system presents marked weakness, or there are great and sudden extremes of blood-pressure. In these cases the tinnitus can, of course, only be considered as symptomatic, and, in the absence of distinct local disease, not causative.

In five cases there was a chronic otorrhœa or some trouble with the middle ear, and in one there was a mastoid sinus. In most of these six there was good reason to believe that the ear-trouble was, on the contrary, largely to blame for the epilepsy—as indicated by the order of de-

velopment, and especially by increase of convulsions on increase or retention of secretions. In three of these (others not specified) the convulsions regularly began on one side or were wholly unilateral—and in at least one of these on the same side as the ear-trouble.

Treatment of such epileptics with ordinary remedies as the bromides has not been encouraging. As they were then usually referred to other departments for relief of the local trouble, the eventual outcome cannot be given. It is, however, certain that inflammatory processes in the ear are an important immediate cause in a small proportion. Of further cases, in one there were hallucinations of hearing, in one intercurrent otalgia, in one sudden deafness, and in one there was unilateral deafness.

(11).—Motor Disturbances.

It is well known that epileptics are often very strong so far as their gross muscular power is concerned,[6] the spasmodic movements possibly acting as a kind of autogymnastics. This, however, applies rather to any transient exhibition of their strength than to sustained effort. Certain it is that weakening indulgences and excesses tend to increase the seizures. Many are chronically languid, tired. Some patients only suffer when exposed to such special cause, *e. g.*, after over-use of alcoholics, or when exhausted by manual labor (evidently the Ermüdungs-epilepsie of Solomon).

The first three of the following forms were collectively termed by Reynolds, "Involuntary Muscular Contractions."

(*a*) Tremor. There are two somewhat distinct forms of tremor in epileptics: one a paroxysmal manifestation, the other an interval symptom. The latter is of importance, as in some cases it is thought to be dependent on degeneration in the pyramidal tracts. When strictly unilateral, or as in one case affecting a single extremity,

[6] Féré, it is true, found a reduction of the general strength, but this may have been due to his class of cases.

such a degeneration is a fair supposition—but it is not as easy to assume this for the cases of equal general tremor, and certainly not for the paroxysmal form. It is also common in the Jacksonian type of seizures. Its frequent occurrence as a purely interval symptom, and the pupillary hippus above described, suggest also a comparison with multiple sclerosis.

In twelve of the last eighty-five cases there was some form of tremor, usually very pronounced. It was increased on excitement, and belongs to the intention type (best shown by attempted steady extension, *i. e.*, fixation of muscles). It seems to have no relation to age, sex (6 m., 6 f.), or previous duration of the epilepsy. It is commonly a fine rapid tremor, but otherwise varies much. It six it was more or less unilateral (exclusively so only in three Jacksonians, but in another distinct Jacksonian the tremor was bilateral); in one it was more an unsteadiness of the hands than a distinct tremor. In other cases, not here included, it occurred only as a premonitory sign of seizure. Its bearing on prognosis does not seem to have been studied, although apparently bad yet such cases have proven about as amenable to treatment as the average.

This sign was noted by Reynolds in fifty per cent. of his cases,—constant or occasional, variable in extent and intensity from tremulousness to well marked vigors.

Féré (1889) has made a careful study with tracings of the muscular weakness and tremor in various epileptics, —principally, however, about the period of the attack, or else in hemiplegic and hemichoreic cases. From his observations it appears that the tremor is greatly increased by, if not largely dependent on general excitement or local stimulation. More recently (*Rev. de Med.*, 1891, pp. 513–522), he has reported two peculiar cases of attacks of trembling in epileptics, and says that these may differ widely in character. Epileptics subject to habitual trembling do not appear, according to him, more liable to this form of crisis than do others. The tremor of the hand in one of his cases showed seven to ten oscil-

lations a second, that of the foot being always a little slower. In the other case (tremor in triceps of right thigh) there were six to seven vibrations per second.

(*b*) Various slight spasmodic contractions—especially so-called "starts"—are very common. Of course, these verge closely on the choreic. They may not be sufficient to move a whole extremity, may not be noticeable unless an exposed area be closely watched or the person be under continuous observation, and are often not known to the patient until attention is directed thereto. Again, they involve the whole body—the form common to many persons at night. Occasionally they are most troublesome just on awakening. An increase in the number of these starts, particularly if diurnal, is a strong indication of an impending seizure, and thus a therapeutic warning.

Reynolds noted some clonic spasms in fifty-seven per cent. of his cases.

(*c*) Epilepsy and chorea. That there is some connection between these two disorders has been variously recognized. Only a few of the facts bearing thereon will here be mentioned. Each is a motor neurosis, and either may be the antecedent of the other.

1. The choreiform movements of epileptics present a considerable variety of type, ranging from the just mentioned clonic spasms to typical chorea minor (fourteen cases of the present series). Reynolds says: "In several children I have noticed a more or less constant condition of choreic movements, these being much exaggerated some days prior to an attack."

It is a question whether in these cases the motor condition shall be considered as ordinary chorea. Rarely it seems to be the common form of childhood; but as it is usually atypical, less severe, and indefinite in duration, it is probably, in most cases, a parallel to hemichorea from brain disease—only that in the epileptic it is more general. Different parts of the body may be unequally affected. Sometimes the twitching is about the head and shoulders; again mostly in the extremities.

In one it was only on the nonparetic side, in another on the side primarily convulsed, and in a third it was more on one side than the other.

2. In rare cases (two) there was an alternation, a period of chorea, then one of epileptic seizures; presently the chorea again, and so on. This may even lead to amusing blunders and confusion in diagnosis. Trowbridge also refers to such cases. Another patient had been a choreic in younger years.

3. Family chorea, choreic heredity. In four cases, at least, a sister or brother had suffered from chorea, doubtless chorea minor.

Putzel (1880, p. 62) gives chorea as one of the antecedents of epilepsy, and also mentions chorea and epilepsy, respectively, in two brothers, with a history of insanity in a great grand-aunt.

Recently, Remak (*Neurolg. Centbl.*, June, 1891), has published a case of hereditary chorea in a man who had suffered from epilepsy some years previously; and also refers to Hoffmann's earlier cases combining both troubles. Jolly (*ibid*) also mentions a girl of eleven years in the same family as Remak's case, showing both chorea and epilepsy; and Bernhardt adds a case of chronic chorea, where father and grandfather were epileptics. Comby, of Paris, has also (1891) noticed epilepsy in the antecedents of choreics.

For comparison, Goodall (*Guy's Host. Rpts., v. Bkln. Med. Jrnl.*, September, 1891) may be quoted. He found that in 28 of 262 cases of chorea, "the family history showed chorea in mother, brother or sister."

G. R. Trowbridge, of Danville (*Alien. and Nrlgst*, January, 1892, pp. 45–63), has collected and added sixteen cases on this subject. His conclusions are:

"1. There is an intimate relation between epilepsy and chorea, both diseases being due to disturbances of the motor and intellectual centers of the brain, which differ only in the degree of intensity.

"2. Chorea predisposes towards epilepsy, and epilepsy towards chorea—the former being the most frequent condition.

"3. Chorea in one generation may be transmitted as epilepsy in the next or succeeding generations, or the epilepsy may appear first and the chorea in the following generations.

"4. That a neurotic taint in the parent or parents may make one child choreic and another epileptic.

"5. The diseases may exist simultaneously, but in these cases they are in inverse ratio, *i. e.*, the more violent the chorea the less frequent and severe the epileptic convulsions; and *vice versa*, the more violent the epilepsy the less marked are the choreic movements.

"6. That in cases of chorea and epilepsy there is more or less mental impairment."

However, such writers, to some extent, overlook the different course of ordinary chorea minor from that of epileptic chorea, the latter more comparable to "hereditary chorea."

The direct therapeutic demands of the choreic manifestations are essentially those of the main trouble. If it be a true chorea attack in an epileptic, the indications are the same as in uncomplicated chorea. Otherwise, where, as is usually the case, the irregular choreiform movements occur, they are as controllable by the bromides as is the epilepsy itself. In some cases arsenic seems to be of value. It is, of course, one of the recognized antepileptics, and, by some, is specially praised as a preventive of bromidism. It is in this latter sense that Agostini recommends it in skin-troubles in epileptics. These indications are almost as much for its general employment as for its value in particular cases.

(*d*) General uneasiness (a habit of never sitting still, of moving about, of picking at things) is frequent, though this is so common among children in general as to make it of less significance. The allied conditions of ocular and possibly pupillary unrest have already been considered.

"Unstable" characterizes the epileptic in all respects.

Occasionally, a patient is recognized to have periods of "pig-headed obstinacy," not maliciousness, but an im-

perative tendency to follow any unaccountable whim. This may either be more or less continuous, or oftener bears some relation to an attack, either as a premonition or as a *petit mal*. In some it approaches the type called procursive epilepsy.

(*e*). Paralyses, pareses and contractures. Those observed in epileptics are usually either manifestations of organic brain disease, or after-effects of the convulsions. Still, in fact, they represent a mixed lot of peripheral and central cases.

Exclusive of the form limited to an eye-muscle and already described, there were fourteen cases of this class (not to mention a slight facial hemiatrophy, general weakness, or for completeness a wooden leg). Hemiparesis occurred in four, arm-paresis in two, facial in two, peronei-paresis, incipient tabes,[7] para-paresis, deviated uvula, retracted toe, and lordosis, each one. In several of these the local trouble developed at some convulsion, and has persisted since, or more rarely is temporarily aggravated by the seizures.

One peculiar feature appears on adding my four hemiplegic (respectively hemiparetic) cases to five seen at the asylum. This shows that eight (7 m., 1 f.) were affected on the left to only one (woman of sixty) on the right. This may well be accidental, yet the number is large enough to suggest that it represents some actual fact—perhaps the greater vulnerability of the weaker right side of the brain.

Partial and transient motor loss as a direct sequence of the convulsions, may also be mentioned here.

Bourneville (1873) noticed that hemiplegia of the cerebral type may occur in *status epilepticus*. Ssikorski (reported in *Neurolg. Centbl.*, April, 1891), asserts "that he has observed on a large number of epileptics (sixty to seventy per cent.) a phenomenon that permits with some probability the establishment of the diagnosis indepen-

[7] As epileptiform attacks are not rare in progressive dementia, it is not surprising that they occasionally appear in the related tabes. And several cases in ataxics have been published.

dent of the attacks. This is a diminution of motility in one-half of the body, especially paresis of the mimetic movements in one-half of the face. On the paretic side the palpebral fissure appears dilated, the nostrils narrower. The weakness usually affects the side on which during the attacks the convulsions begin."

So far as the grip (dynamometer) is concerned, this was not found to hold in the cases where the attacks at times began in a hand or arm. Slight ptosis in a couple of cases served rather to narrow than dilate the palpebral fissure.

Contractures, instead of pareses, as post-paroxysmal occurrences, have been reported by Lemoine.

(*f*) Speech impediment or defect. In all there were twelve cases of this; the trouble in three of these being worse for a time after each seizure. Aphonia following a fit, and even lasting until the next one, is mentioned by Romberg. No single special type predominated in the above. In three the main feature was a lisp; in two partial aphasia; in two unintelligible pronunciation, then stammering, inability to combine certain sounds, etc. Of the twelve, there were ten under eighteen years of age, showing an overproportion amongst youthful epileptics. Of course, a few of these showed other evidence of brain defect or weak-mindedness. In one the trouble developed under observation.

(12).—Sensory Disturbances.

1. Considerable headache, *independent of the seizures*, is a frequent complaint. It is, of course, also common just after an attack, and sometimes occurs as a prodromal. But as a more or less continuous or frequent symptom in the free interval, it was noted in thirty-three cases, fourteen of these being males. Still others suffered occasionally. Where the location was specified, it was nearly always frontal (eighteen frontal, a couple of others partially so, two more or less temporal and unilateral, two vertical, eleven indefinite). The predominance of the

frontal site is so great as almost to constitute this the typical form of the epileptic interval. Indigestion, nicotine poisoning, eye strain, acute sexual exhaustion, and epilepsy cause, preferably frontal headache,—evidently having cerebral exhaustion as a common element.

In twenty-one other cases it is specifically stated that there was no or but very rare headache (11 m., 10 f.). A comparison shows that this is proportionately less frequent in the older epileptics, but three of the thirty-three sufferers being over thirty years of age, as against forty in the whole series of one hundred and fifty. Evidently this headache cannot be figured as a chronic after-effect of the convulsions,—firstly, because care was taken in enquiring, to distinguish the cases where the headache was either post-convulsive or sharper at that time; secondly, because a comparison of the cases shows that those with long intervals had suffered quite as much and continuously as the rapid fire cases. This, also, negatives the general applicability of the view approved by Putzel, that blows on the head in falling are one important factor. Happily, it can be said, that these headaches of epileptics are very responsive to treatment. This, however, has simply to follow the general lines for the case as one of epilepsy. Sometimes the relief is immediate and continuous, again it is gradual.

Recently, Kreuser (reported in *Neurolg. Centbl.*, 1891, p. 740), has investigated the "pressure-sensitiveness of the cranial sutures" in health and disease. For epileptics he found such tenderness absolutely more frequent than in healthy persons, decreasing as the age the duration of the sickness and the mental deterioration increased. It was not regularly increased after single or frequent attacks. More often than in other investigated cases there was in epileptics an asymmetrical state and radiation of the sensation to a greater distance. The sagittal suture and the sites of the former fontanelles were commonly most sensitive.

2. Pain and paræsthesiæ,—other than headache. Patients frequently tell of peculiar sensations, of near

objects appearing transiently distant, of pains and indefinite feelings that can best be classed as paræsthesiæ (not of the Jacksonian type, but occurring irregularly, first in one part, then in another). These sensory phenomena seem at times to bear some relation to a full seizure (pre- or post-signs); or when associated with confusion of thought, they doubtless represent a minor attack. Dizziness is very common, and usually, though often falsely attributed to *petit mal*. Pain about the cardiac region and tinnitus aurium have already been considered. A lump in the throat or a feeling of something rising is suggestive of an aura or of hysteria, but may be more or less continuously troublesome in epileptics presenting no other manifestation of hysteria.

3. Sensory loss. Visual limitation has already been considered. Féré finds that about sixty of every hundred epileptics examined showed diminished appreciation of odors and flavors.

Gottardi (1881) concluded that tactile sensibility, as determined by Weber's compass immediately after an epileptic attack, is of no value as a means of diagnosis. But Thomsen and Oppenheim have found sensation to be greatly reduced in old epileptics. The sensory impairment of epileptics is evidently on a par with the degree of their intellectual weakness. In two of the present cases it was stated that the patient never heeded pain, as from cuts or burns. One of these was a weak-minded girl, long epileptic; the other was a boy who, although less weak mentally, was so clumsy as to be unable to button his clothes. Neither was at all ataxic, and each seemed to feel pinching and pricking about as sharply as other children,—but any thorough examination was impracticable.

Roncoroni (1892) finds that disturbances of sensation are most frequent in the epileptic insane, then in the melancholic, and least in the maniacs.

As an amusing sensori-motor item, it might be mentioned that one boy's mother expressed her joy at the success of treatment, by explaining that now she could "lick him" to her heart's content without the access of

a fit—something long previously impossible. She evidently made such use of the reclaimed possibility that—although he certainly deserved well at her hands—I almost regretted his improvement.

(13).—Reflexes.

Ziehen (1889) says that in adults the presence of ankle-clonus, without other marked objective symptoms, should always suggest epilepsy or neurasthenia. Ankle-clonus and exaggerated knee-jerk occurred in sixty per cent. of his cases of epilepsy, while the plantar reflex was often weak. However, in a considerable number of my cases examined therefor, not one showed any suggestion of ankle-clonus. And as regards the patellar reflex, this was oftener (six times) found unequal than either increased or decreased. My observations on the plantar reflex are not sufficient to warrant any suggestion other than that on this point Ziehen may be right.

Beevor's observations on the reflexes in epilepsy (*Brain*, 1882), had reference to the convulsive period.

Drayton's statement (*l. c.*): "A relaxed state of the muscles, yet the responses of the reflexes to local irritation are abnormal or exaggerated;" is too general. And Agostini's paper ("Sulle variazioni della sensibilita generale a sensoriale e reflessa negli epilettici; nel periodo interparossistico e dopo la convulsione," 1890), is not at hand.

Bechterew, from studies with his "Reflexograph" (*Neurolg. Centbl.*, 1892, pp. 39–40), treats as follows of the tendon-reflexes in epileptics: "The patellar reflexes are changed in various ways and to a most striking degree. In many cases the reflexes were increased and at the same time usually unequal; but during the attacks of *grand mal* there was complete abeyance of the tendon-reflexes. In many cases they remained absent for some time immediately after the attack. In another series of cases a temporary increase of the reflexes or change in character of the curve (*i. e.*, of the reflexogramme) was found." But most of his article, so far as it relates to

epileptics, is also devoted to the post-convulsive phenomena.

The pupillary reflex has already been considered and loss of the pharyngeal reflex as a symptom of severe bromidism is, of course, well known.

(14).—Mental Peculiarities.

These deserve a far more careful study and recapitulation than will here be attempted; indeed, extensive papers have been devoted to this phase of the subject. The present question in their interpretation is to determine, in any given case, whether they are simply results of the convulsions, or are coördinate symptoms (*i. e.*, practically convulsive phenomena), or finally are, like the convulsions, but manifestations of a primary degenerative condition of the brain. The time of their original development, relative to that of the seizures, is important in determining this. If they antedate the latter some degenerative type is probable and the prognosis decidedly the worse. Again, the nature and severity of the mental disturbances usually give us evidence on this point. Impairment of memory is a common sequence of epilepsy; hypochondria and hysteria have been noticed as interval symptoms (Griesinger); whilst idiocy, alienation,[8] dementia, coprolalia, echolalia, a habit of lying, etc., are of deeper significance and give the worst prognosis. Still, there is hardly one of these symptoms or conditions but may improve, and all but the worst are occasionally curable. Imbecility may be a result of long-standing epilepsy and then be more amenable to treatment. In the present series there were no real imbeciles, and but, perhaps, three who might fairly be classed as weak-minded.

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[8] Epileptic and so-called post-epileptic insanity belong rather to the period of the attack (*i. e.*, are either substitutive or post-paroxysmal). This is the transitory insanity of certain epileptics (Wildermuth) as distinguished from the common chronic psychic degeneration. This latter is observed to follow more certainly and rapidly the mild paroxysms unattended by convulsions (Hammond).

Next come children that are termed "peculiar," that withdraw from playing or associating with their fellows, perhaps have somnambulistic tendencies, are inveterate masturbators, etc. The latter habit does not seem specially provocative of epilepsy, despite certain claims, but is rather an ominous sign of the mental condition. Certain forms of chorea, already alluded to, sometimes alternating with epileptic periods, presaging a seizure, or representing an irregular tic, darken the prognosis, though not absolutely. Obstinacy, moroseness, ugliness, uncontrollable temper, excessive irritability, restlessness, loquaciousness,[9] forgetfulness, and such other mental deviations may be transient and remediable; but when decided and settled conditions point to degenerative states (not necessarily dementia or imbecility at first).

Children that are simply weak or feeble-minded or backward have, of course, a less favorable outlook according as this represents a real mental defect. Such cases, however, should only be passed upon after due consideration of the person's general condition and intellect in view of surroundings and privileges.

Here the advantage of mental treatment might be mentioned; *i. e.*, training of the patient's self-control. Moderate mental discipline assists in this respect, and helps, also, to weaken the attacks by drawing force from the explosions.

Seguin at one point (*l. c.*, p. 203), speaks of "the moral perversion which characterizes it (so few epileptics can be good, true or kind)." Heedless cruelty is some-

[9] Relative to age and surrounding circumstances. It is not very frequent, but may be observed in either sex, and, although on a par with restlessness, is distinct from such forms of imperative utterance as coprolalia. Nor is it the "Epilepsy Loquax," described by Cheadle (1875, *v.* Hare,) as it is not an epileptic equivalent, but a more or less continuous manner of the patient in the free intervals. Hare (p. 21), in speaking of "Precursory symptoms other than auræ," says: "Still other cases are recorded in which an extraordinary loquacity asserted itself in men of a commonly morose or taciturn nature." Choking, spitting or talking in the attacks marked two of the present cases; *per contra* silence was a premonitor in one.

times shown; one boy killed a kitten without any purpose; another smashed a slate over a comrade's head on a slight provocation; and other like incidents might be added. It is this characteristic, combined with a bad temper, that makes some epileptics feared, even in their own home.

There is another trait that is more frequent in the brighter epileptics than in other children, though often enough noticeable in the latter also. It is oftenest discovered by chance, yet on gaining the patient's confidence and inviting a recital of their every-day life, the peculiarity may gradually appear. Practically, it is an inclination to do all manner of unhygienic acts, an inability to learn and follow the every-day rules of healthy living. In some this may be only a childish recklessness or wantonness, but more often these acts are done slyly. A child sits up in bed all night reading some book; one youth of puritanical training, when away at school, drank regularly a couple of bowlfuls of coffee at dinner and three or four cups at supper; girls will indulge in smoking, or stay late at balls; one young woman, "just to try it," indulged in paregoric that had been given to a child for sleep; girls are prone to eat immeasurable quantities of sweets or sours,—this not from any bulimic impulse; one girl would, at times, manage to go all day without eating, yet without reason and without attracting notice; another girl would get her feet wet and go about thus for hours; to attend exciting performances is another not rare hobby; in fact, indulgence in injurious "tricks" of any kind or degree. Of course, all children, and especially girls, are more or less given to these eccentricities; but in the same grade as these dispensary epileptics it can hardly be as common or as variedly and persistently practiced. In some other class or country this tendency might exhibit itself in other ways. Boys and adults need to be watched quite as closely as girls,—are even more difficult to detect, or at least to recognize as precocious and abnormal. When once told that it is injurious, the particular prescription is rarely transgressed

(this, of course, should be verified by companion or parent who has been put on the watch). It is not the "showing off" of childhood, nor yet hysteria, since there is no effort to be seen by nor to appeal to others. It is not quite mischief, pure and simple, as it injures principally the patient's self and does not include selfishness. It is, perhaps, a fancy for excitement, or to appear bizarre to ones self, or more likely an easy yielding to any sudden fancy—vagary, caprice, whim—a lack of the mental inhibition that should follow from reason and logic even in persons of this age -possibly here again "unstable."

Whether this be a result of the disorder, or a part cause, or but the folly of youth, it is often a serious impediment to success in treatment. Not infrequently relapse, retrogression, or intractibility to remedies, has clearly been due to these follies. As even those constantly about the patient are usually unable to give the needed information, it becomes one of the most difficult phases to work out, and yet should be continuously borne in mind. How general this characteristic is in epileptics it would be difficult to say, but it is at least common.

(15).—Summary.

In his "System of Medicine" (Am. Edt., 1880, I., p. 775), Reynolds reaches the "conclusion, that in a certain number (twelve per cent.) there is nothing, absolutely nothing, abnormal to be discovered during the intervals of the attack." In the present series, all the more carefully examined cases before middle life have shown some one or more, and usually several, deviations from normal types. Thus, owing to the more recently noted variations, and perhaps to improved plans of observation, even this remaining twelve per cent. of Reynolds is wiped out, and it may fairly be stated that all younger epileptics, on careful and repeated examination, show distinct deviations from the healthy norm. To a considerable extent these deviations are only such as may be

discovered in many non-epileptics of like age. To record the observance of new manifestations in epileptics is not to say that they are diagnostically very characteristic. In glancing over the conclusions of various observers—as they from time to time appear in the journals—one cannot but note how often there has been an error in the belief that some pathognomonic interparoxysmal sign had been found. Certain pertinent questions arise here: 1. Are any of these, simply or collectively, in any sense characteristic of epilepsy? 2. Are they coördinate symptoms of the epileptic disorder, or are they causative of the same, or are they merely consequences?

It is not the special purpose of this paper to answer these questions. But so much may be said, viz., that as yet positive and general answers cannot be given. To some extent, as regards single symptoms or conditions, the queries have already been considered. None, either alone or combined, are strictly characteristic (pathognomonic), though several are relatively so, *i. e.*, they are much more common and pronounced in epileptics than in other apparently equally healthy individuals of the same age. They hardly suffice in any case to justify a positive diagnosis of epilepsy—in the absence of any knowledge of the convulsions, or of previous history—though in many cases they might constitute strong presumptive evidence.

As to their relation to the main trouble, it is clear that they are in varying degrees causative, coördinate, and sequential,—all three.

It is their status as causative or coördinate conditions that furnishes the basis on which to determine the continuance of treatment. The type and symptoms of the seizures are of but the slightest therapeutic interest,—except as to the general question of surgical versus medical means. That, on the contrary, the interval symptoms and conditions individually furnish many indications for treatment, has been above pointed out in connection with the study of each. But it is rather to their importance, taken in any case collectively, or so far as

present, in giving us a warrant for the gradual cessation of medicinal treatment, that it is desired here to call attention. Commonly, the progress of a case is simply estimated by the varying number of seizures. The prime object in these observations has been to work out a plan whereby this can be followed and known without depending on the occurrence of attacks. These latter are universally recognized as strongly tending to perpetuate the convulsive habit. Hence, whenever our therapeutics can control such manifestations, if there is to be any chance of cure, it is that such control be continuous. It is in just such more hopeful cases that we soon find ourselves at sea for want of indications. Moreover, where anything like a cure is to be hoped for, treatment must, it is well known, be kept up for a long period after all such manifestations have been checked. It is in this free period that these interparoxysmal matters acquire their main value as guides. By them we can, in such cases as are controllable, keep a pretty good insight as to the underlying epileptic condition, and just as fast as this is found to improve we can reduce any one or all the drugs that are being administered, respectively, if necessary, increase them.

Of course, the present essay is but an attempt in the direction specified. If it be even an entire failure, the desideratum here outlined remains, and in any case there is much to be verified, and an ample field for further work.

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